AUGUST, 1954

HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION

Air Cooled TV Studios
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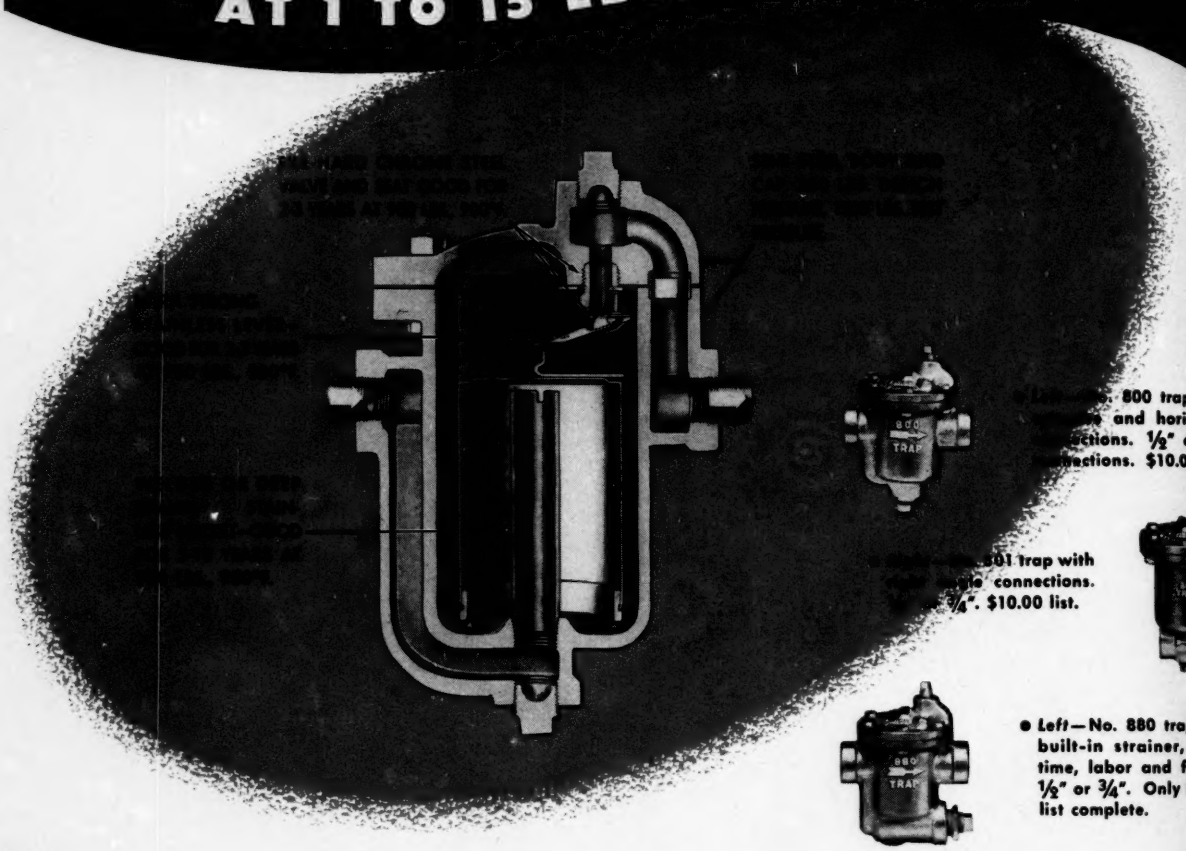
HOW LONG WILL THIS TRAP LAST AT 1 TO 15 LBS. PRESSURE?



• Left—No. 880 trap with built-in strainer, saves time, labor and fittings. ½" or ¾". Only $11.50 list complete.

HERE'S A TRAP mechanism for low pressures that is identical in design, materials and workmanship to that used in traps for pressures to 950 lbs., temperatures to 900°F.* You know that it will last a LONG TIME with an absolute minimum of maintenance on a low pressure heating system.

Users report: "4 to 5 years without service"..."10 years—no repairs"... "30% to 50% less maintenance."

Add to the high quality, low maintenance features of this trap the following benefits: large air handling capacity (blast buckets with auxiliary thermic vents where you need them)... self-scrubbing action... immunity to corrosion... ease of installation—and you have an unbeatable trap for any heating job.

Call your nearby Armstrong Representative for details and prices.

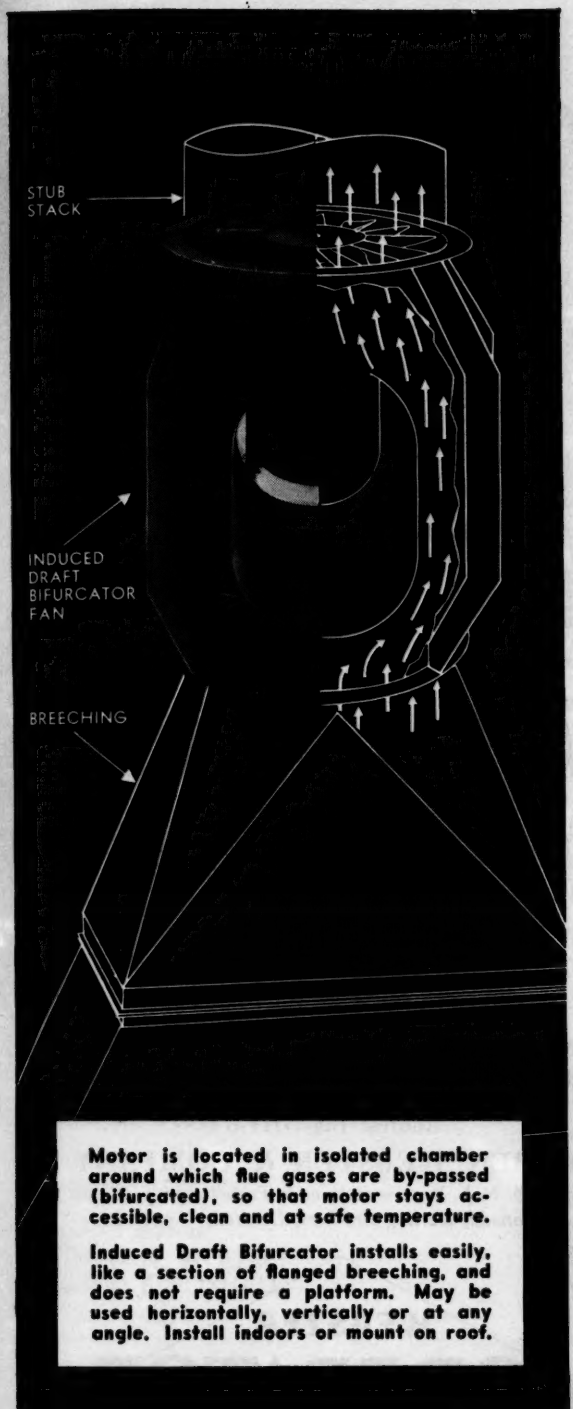
ARMSTRONG MACHINE WORKS
846 Maple Street, Three Rivers, Michigan

**Mass production of traps for all pressures makes it possible to deliver this mechanism at no premium in price.*

SEND FOR CATALOG...

The Armstrong Steam Trap Book gives complete catalog information on Armstrong traps, explains trap selection and installation. You are welcome to a copy.

ARMSTRONG STEAM TRAPS



Motor is located in isolated chamber around which flue gases are by-passed (bifurcated), so that motor stays accessible, clean and at safe temperature.

Induced Draft Bifurcator installs easily, like a section of flanged breeching, and does not require a platform. May be used horizontally, vertically or at any angle. Install indoors or mount on roof.

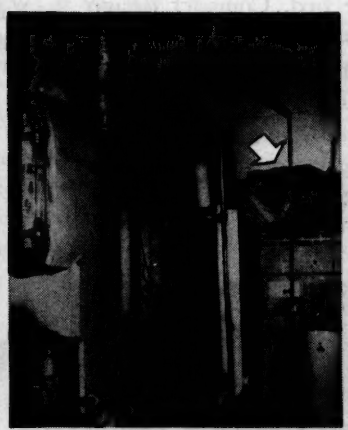
ELIMINATE TALL STACK...SAVE on COST and MAINTENANCE

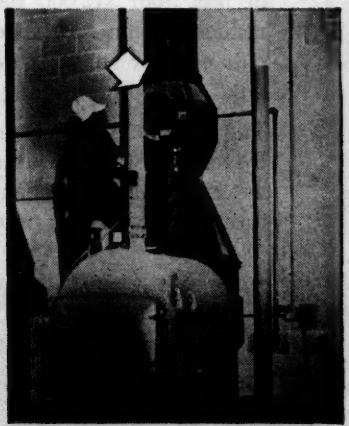
BIFURCATOR FAN

provides controlled boiler draft

The Induced Draft Bifurcator Fan provides controlled draft for boilers and furnaces under all weather conditions, and yet costs only a fraction as much as a tall stack. An Induced Draft Bifurcator Fan also solves the draft problem when you have no room for a tall stack or object to its unsightly appearance.

Bifurcators provide adequate draft for high-pressure boilers delivering up to 60,000 pounds of steam per hour and for low-pressure boilers rated up to 190,000 EDR. For specifications and construction details, use the handy coupon to request free Bulletin DB-32-53.





DeBothezat Fans

Division of American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

DeBOTHEZAT FANS, DEPT. HV-854
Division of American Machine and Metals, Inc.
East Moline, Illinois

Please send me free Bulletin DB-32-53 containing data on Induced Draft Bifurcators.

FIRM NAME

STREET ADDRESS

CITY ZONE STATE

ATTENTION OF MR.

New $3-million Euclid-Glenville Hospital. Main building is at left. One-story wing at right houses administrative offices. Adjunct facilities are in 3-story wing at rear. Architect: Conrad and Simpson. Consulting Engineer: Vincent Eaton. Consultant: Russell B. Crawford, M.D. Heating Contractor: Gorman-Lavelle Plumbing & Heating Company. General Contractor: Cleveland Construction Company.

Hospital Heating . . . Weather-Controlled

Compact new six-story Euclid-Glenville Hospital utilizes unique design to hold down costs. Heating comfort with low fuel consumption is assured with "Controlled-by-the-Weather" Webster Moderator System.

The new 200-bed Euclid-Glenville Hospital, near Cleveland, Ohio, was built at a construction cost of less than $12,000 per bed. Compact design reduces traffic . . . speeds nursing service . . . cuts exterior wall space per square foot of floor area . . . eliminates long pipe runs.

The ten-zone Electronic Webster Moderator System of Steam Heating varies the steam flow automatically with changes in outdoor temperature. Zone Variators permit manual regulation of heat delivery for quick warm-up and reduced night heating. Webster Metering Orifices in each Webster Convector balance steam distribution to all radiators at the same time. Webster Radiator Valves provide individual *complete* shut-off at each radiator . . . Webster Traps keep radiators free of condensation at all times.

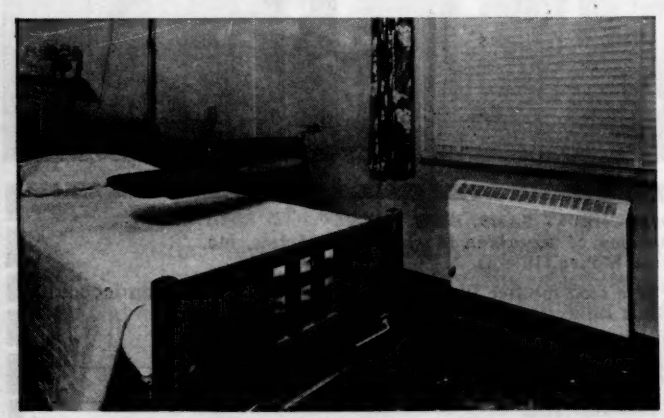
For more information, call the Webster Representative near you, or write us.

Address Dept. HV-8

WARREN WEBSTER & COMPANY

Camden 5, N. J., Representatives in Principal U. S. Cities

In Canada, Darling Brothers, Limited, Montreal



Webster Convectors, shown here in a semi-private room, are used throughout the hospital. This completely prefabricated unit incorporates a Webster Supply Valve with convenient manual complete shut-off, orifice, copper tube and aluminum fin heating surface, and genuine, long-life Webster Radiator Trap – all enclosed behind a substantial furniture steel cabinet.

WEBSTER

MODERATOR

SYSTEM

OF STEAM HEATING

"Controlled by the weather"

AND Other Webster Heating Equipment for hospital use includes Tru-Perimeter Heating with Webster Walvector and Webster Baseboard Heating; Webster Control for Hot Water Heating; Webster Steam Heating Specialties for heating and process applications; Unit Heaters.

HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, PLUMBING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

AUGUST, 1954

VOLUME 51—NO. 8

The Cover. Main video control room of station KSTP-TV, Minneapolis-St. Paul. Air movement from grilles is kept low for comfort and to avoid noise.

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Washington News

LORING F. OVERMAN

AT press time for this column, Congress was swinging a broad economy axe in its haste to prepare for adjournment, but there were many in Washington who considered the action as somewhat of a grandstand play which would be "corrected" by conference committees.

If the present cuts are permitted to stand, it will be something new in Washington history—at least in its recent history. Some of the cuts have a more or less direct bearing on the heating, ventilating and air-conditioning industries, for they involve construction, hospitals, ship building, the business census, and others.

How Congress felt, during the last two scheduled weeks of the 83rd session, is evidenced by the fate of a $2 billion supplementary appropriations bill. The measure was slashed by nearly 40% by the House Appropriations Committee. A proposal to spend $1.1 billion for military construction was trimmed to $571.6 million and the Department of Defense was told to use some of its unspent funds.

In another drastic slash, a request for $82.6 million for ship construction was cut to $11.1 million. Of $43 million requested for unemployment compensation grants-in-aid, only $4.6 million was allowed. A request for $85,750,000 for civil defense was cut to $43,525,000.

The committee also eliminated all funds to finance censuses of business, industry and mining. The business studies had been authorized by earlier Congressional action, at an estimated cost of $8.4 million.

FHA Fares Better

Despite the fact that hearings on FHA scandals had not been completed, House and Senate Conferees agreed on a home mortgage insurance program which conforms in general to Administration proposals. As approved by the committee, the bill (HR7839) (1) provides an additional $1.5 billion in FHA lending authority, and gives the President authority to add another $.5 billion if needed; (2) liberalizes Section 203, the sale housing provision, with respect to maturity, loan to value ratios, and down payments; (3) re-charters the Federal National Mortgage Association along the lines proposed by the Administration; (4) authorizes 35,000 new public housing units in fiscal year 1955; (5) authorizes FHA to insure open-end mortgages; (6) liberalizes FHA-insured loans on existing structures.

The bill rewrites the Title I home improvement program to ban loans for "frivolous purposes" and to put a stop to some of the practices which have been made the subject of the current investigation of FHA procedures.

Meanwhile, the need for a continuing program of low cost housing is spotlighted by the fact that June, 1954, brought the highest single month's total of GI home loan appraisal requests received by the Veterans Administration in nearly four years. More than 92,000 requests for appraisals were received during the month.

As a further step toward reserving FHA-financed housing for those requiring actual living quarters, the Conference committee adopted an amendment specifying that in the future no apartments built with FHA mortgages can be converted into hotels.

Defense Planners Alert

Although the domestic economy was being given much attention by Washington, on every side there were indications that defense matters must not be neglected. If some business men have forgotten that a priorities system of sorts is still in operation, a June action of Assistant Defense Secretary Thomas Pike may come as a surprise. His office has restated the rules to be followed by specified Government agencies in reporting requirements for steel, copper and aluminum under the Defense Materials System. The new rules are contained in Defense Instruction No. 4210.7. Funds available for defense are made one of the principal bases for reports. The official text observes: "The quarterly reports submitted in compliance with this instruction will be based on all funds made available or estimated to become available from the current fiscal year or prior years' appropriations and on funds included in the most recent estimates for the succeeding fiscal year, from all services, as are applicable to the particular programs involved."

In another restatement of rules, the General Services Administration lists the conditions for debarment of bidders in connection with government contracts. The new GSA General Regulation No. 15, effective July 15, is mandatory on all Federal Executive Agencies in negotiated or advertised purchasing, and in contracting for the construction, repair, alteration, destruction, or dismantling of public works or buildings.

Under the new rules, a consolidated list of debarred contractors is maintained by each agency as confidential information for use by all of the agency's contracting officers. Additions to the list, or removals from it, are to be reported to GSA. In turn, GSA will furnish the information to other agencies. The regulation bases debarment on four grounds: (1) conviction of a criminal offense connected with the contract; (2) conviction of an anti-trust violation in submitting bids; (3) clear and convincing evidence of violation of contract provisions, and (4) debarment by another agency. The regulation provides for total and partial debarment, specifies three years of ineligibility for infractions of labor laws, and permits agencies to exercise discretion in fixing the debarment period for criminal offenders and contract breakers. It is understood that 500 names are on the blacklist which is not to be made public.

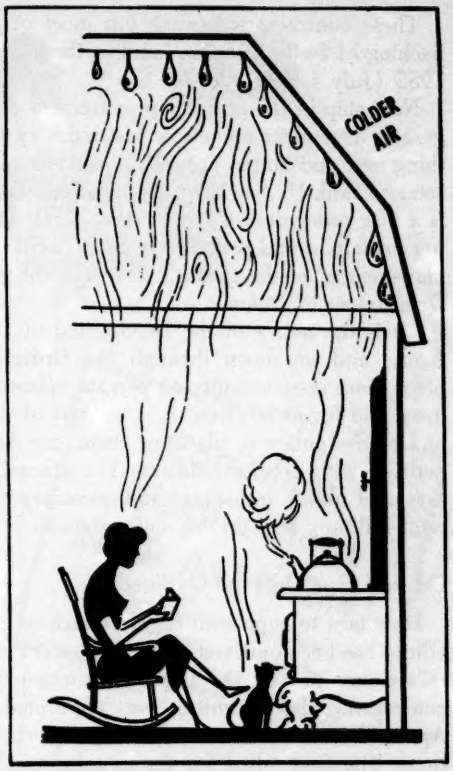
Air Force in Buying Mood

Proud of its new F-100 Super Sabrejet—said to be able to travel faster than sound in level flight—the Air Force expected to place firm orders during the next four months for a billion dollars worth of planes and parts. Much of the billion will go for the new plane, with production and re-ordering continuing until aircraft designers come up with something better.

How to Stop CONDENSATION!

Prevent Damage to Wood, Plaster, Paint, etc.

Condensation forms when temperature of contacting air is reduced below dew-point by a cold surface.



Condensation forms when the capacity of an air space at a given temperature is too small for the amount of vapor present. →

As air grows colder, it can hold less vapor in suspension. The degree of saturation increases until a dew-point is reached, and condensation occurs. The surface of a material colder than contacting air it faces which continuously loses heat on the other side, continuously extracts heat by conduction from the air it faces. The denser and bulkier the material, the more heat it can extract before attaining room temperature, if it *ever* does.

The scientific construction of multiple layers of accordion aluminum, fiber, and air minimizes condensation formation on or within this type of insulation. The reason: The temperature of the air in the warm room and the adjacent sheet of aluminum is about the same. Because the aluminum sheet weighs only ¼ oz. per sq. ft.; has heat ray absorptivity and emissivity of only 3%; it extracts from the air by conduction only enough heat to attain and remain at room temperature.

Since the other sheets of aluminum and fiber retard heat flow by inner as well as outer convection, and conduction is low because of preponderant air spaces of low density, the sheet's other surface faces a space which is only a *little* colder than the aluminum itself. Because warmth flows to cold in radiation and conduction, the aluminum will *give off a slight* amount of *heat* to the colder space, thereby slightly *increasing* the vapor retaining capacity of that space. The succeeding reflective spaces and aluminum sheets behave similarly. Since each aluminum surface is slightly warmer than the air it faces on its cold side, there is no extraction of heat. *(The reverse is true.)*

Where multiple accordion aluminum is used, fortuitous vapor and water (like rain) which intrude into building spaces will, as the vapor pressure develops therein, gradually flow out as vapor through exterior walls and roofs because vapor flows from areas of greater to less density. Since the vapor cannot back up through the continuous, impervious aluminum, it will flow out because exterior walls and roofs have substantial permeability in comparison (with the aluminum), far greater than the required 5:1 ratio.

Of great importance is the use of a continuous metallic vapor barrier of zero water vapor permeability to retard the outward flow of vapor which originates inside the house. Infiltration under the flat stapled flanges of multiple accordion aluminum is slight.

A new multiple accordion aluminum, Infra Types 6-S and 4-S , forms a continuous "blanket" of uniform thickness between joists, giving the entire area maximum protection against heat loss and condensation formation. Write for samples and description.

The U.S. Bureau of Standards has prepared a helpful and informative booklet, "Moisture Condensation in Building Walls," which discusses causes and cures. Use the coupon to get a free copy from us.

COST OF INFRA INSULATION INSTALLED in new construction between wood joists, material with labor,

Type 6-S under 9½¢ sq. ft.
Type 4-S under 7½¢ sq. ft.

Infra Insulation Inc., Dept. V-8
525 Broadway, New York, N. Y.

☐ Please send FREE U.S. Bureau of Standards Booklet BMS63

☐ Please send samples

Name_____

Firm_____

Address_____

INFRA INSULATION, INC., 525 Bway., New York, N. Y. WOrth 4-2248

These contracts will wash out most of the Air Force backlog of $4.5 billion on hand at the beginning of fiscal 1955 (July 1, 1954).

Next step in the military procurement program will be greatly dependent upon how fast industry develops something new and better, according to Assistant Defense Secretary Frank D. Newbury, Applications Engineering. His is a new post, created "to see that good, sound engineering principles and practices are used in the planning and management of the gigantic development program of the Department of Defense.

"It is the policy of the Department of Defense, of the Army, and on down through the Ordinance Corps to place more responsibility on private industry for development and for production. It is no part of the Department of Defense policy to place an Ordnance Arsenal in competition with private industry. The arsenals are a necessary and highly important and necessary element of our total military and private defense team."

Oil and Gas Defense Outlined

How best to cope with enemy attack on oil and gas facilities has been outlined by the National Petroleum Council's Committee on Oil and Gas Emergency Defense Organization. The committee was appointed by NPC last April. The committee report included six recommendations. The first called for the appointment of emergency committees of industry men, to guide emergency operations on a decentralized basis in the event of atomic attack. It was also suggested that a program be in readiness for action immediately in the event of a Presidential proclamation. The proclamation should give the emergency committee power, if necessary, to requisition materials, supplies, crude oil or products, and natural gas. In addition, it was suggested that a list of priorities be set up for allocating products in event of attack.

Another recommendation called for the reorganization of a Petroleum Administration for Defense, or some similar body, immediately following an attack. Such an organization would report directly to the Secretary of the Interior. The special committee urged that oil companies consider further decentralization when planning expansion, and that gas companies consider underground storage and interconnecting distribution systems.

The committee also recommended a build-up of such transportation equipment as tankers, tank cars, barges and tank trucks.

Continuing interest in defense matters failed to protect the Office of Defense Mobilization from the Congressional economy drive. Funds for ODM were cut back by $375,000, resulting in a 25% reduction in the staff of the agency. The cut will not affect operations seriously, according to Defense Mobilization Director Dr. Arthur S. Flemming, for the work will be assigned to old line agencies. He said that the enforced staff reductions will accelerate a trend with which he is in full accord. He feels, he said, that by using the know-how of the old line agencies, much duplication is avoided, and the work-together spirit is developed.

Washington Miscellany

Plane Industry Leads. The aircraft industry now leads the automobile factory as the top employer of manufacturing workers, according to the U. S. Bureau of Labor Statistics. The Bureau's figures credit aircraft and aircraft parts makers with a payroll of 823,000; the automobile industry, 786,000. Average weekly earnings for March, the latest available, were $84.72 for production workers in aircraft and parts industries, as against $70.71 for all manufacturing industries. Including families of workers, it is estimated that 1,900,000 Americans are directly dependent upon the plane and parts industries.

In third place as an employer is the blast furnace, steel workers and rolling mill industry, with 594,000 employees. Communications equipment makers come next with 503,700 workers, and broad-woven fabric mills fifth with 489,000.

U. S. Scientists Trail USSR. Although the number of scientists and engineers in this country is increasing, the number in relation to those reported by the Soviet Union is not impressive. According to Dr. Harry C. Kelly of the National Science Foundation, there are now about 500,000 engineers and 200,000 scientists in this country—less than one-half of one per cent of the total population. Dr. Kelly warned that in the USSR there are some 400,000 engineers and 150,000 scientists, and that the number is increasing at a rate exceeding that of the United States.

Dr. Kelly pointed out that nearly half of the high school graduates who have the intelligence to do college work do not go to college, while an appreciable number of those who enter college do not finish. Dr. Kelly considers that one of the grave problems facing the nation is how to use these crucial skills, and at the same time to preserve the freedom essential to the advancement of knowledge.

Atomic Fuel Reserves Ample. Known reserves of uranium indicate a potential world atomic fuel backlog at least 25 times greater than our fossil fuel supply in the forms of coal, oil or gas.

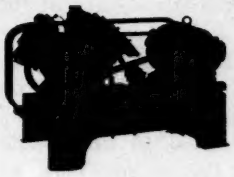
Coal Study Group Named. A new study group "to explore the danger to the well-being of the nation, created by present conditions in the soft coal industry," has been set up by the President. The group, with instructions to submit recommendations for remedial action as soon as possible, will serve under Arthur S. Flemming, director of the Office of Defense Mobilization. In the group will be representatives of State, Defense, Interior, Commerce, and Labor Departments. The President's letter to Dr. Flemming, expressed concern about "The danger of serious loss of capacity to produce coal."

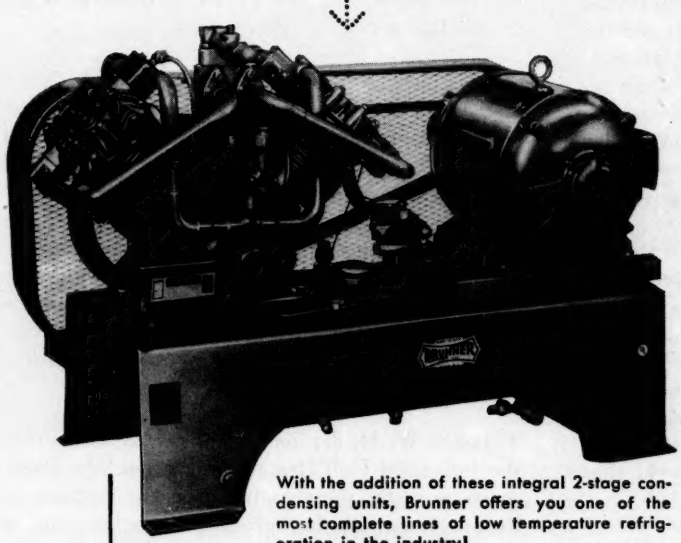
Smoke Abatement Plan Killed. Efforts to include FHA financing for smoke abatement equipment in the omnibus housing bill (HR 7839) failed when House and Senate conferees voted to have the provision stricken from the bill. The proposal had been sponsored by Senator Capehart (R—Ind.).

Critical Materials Study Approved. The Senate Rules Committee in Senate Resolution 271, authorized the Senate Interior Committee to use $34,000 to finance continued study of critical raw materials and their availability to this country in time of war. Senator George Malone (R—Nev.) is chairman of the Interior Sub-Committee, which has been studying the subject for several years. Voluminous testimony taken in hearings before the committee supports the position that this nation must concentrate on development of domestic raw materials sources, and reduce its dependence upon foreign nations.

why use two ⟶

when one will do ?





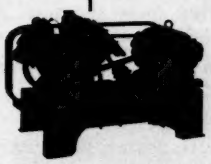
With the addition of these integral 2-stage condensing units, Brunner offers you one of the most complete lines of low temperature refrigeration in the industry!

Complete Specifications Now Available!

. . . Ask your Brunner representative or wholesaler . . . or write us!

BRUNNER INTEGRAL 2-STAGE CONDENSING UNITS OFFER NEW EASE AND ECONOMY IN LOW TEMPERATURE APPLICATIONS

Now—with these integral 2-stage Brunner units—you can easily handle, with one unit, many low temperature applications that formerly required hook-ups of two or more condensing units! Designed for use with both F-12 and F-22 refrigerants, these Brunner units have ratings as low as −100°. Ideal for use in cold test chambers, frozen food, metal processing and other jobs where sub-zero temperatures are desired. Saves time and dollars on installation and maintenance costs, too...



Brunner 2-stage condensing units are available in 15 models, ranging from:

3 H.P. to 30 H.P.

BRUNNER MANUFACTURING CO., Dept. K-84 UTICA, N.Y.
The Brunner Company, Gainesville, Ga.
In Canada: Brunner Corp. (Canada) Ltd., Toronto, Ontario

As seen in The Saturday Evening POST

BRUNNER SINCE 1906 means more in '54

BRUNNER REFRIGERATION IS ADVERTISED IN THE SATURDAY EVENING POST

BRIEFLY STATED

• Charles Ferdinand Roth, president of the International Exposition Company and manager of the National Exposition of Power & Mechanical Engineering (Power Show), International Heating and Ventilating Exposition, and Exposition of Chemical Industries, died June 24, as the result of an automobile accident. He was born in New York, December 24, 1886. In 1915, while chief chemist for the Standard Oil Co., of New York, he organized the Chemical Exposition as an aid in relieving the strategic material shortages of World War I. During the same period he served as consulting chemist for the International Filtration Corp., and director of the Beckman and Linden Engineering Corp. In a career of forty years, he organized and managed more than sixty industrial expositions.

• E. K. Stevens, vice-president and treasurer of the International Exposition Company, has been elected president, succeeding the late Charles F. Roth. He also becomes manager of the National Exposition of Power and Mechanical Engineering, International Heating and Ventilating Exposition, and the Exposition of Chemical Industries. Mr. Stevens, a mechanical engineer, joined Mr. Roth, some twenty years ago, as associate manager of these and other expositions, and has served continuously in that capacity.

• Organization of the advisory committee for the 21st National Power Show has been completed under the continued chairmanship of I. E. Moultrop, consulting engineer, of Boston. As heretofore, the exposition will be under the management of the International Exposition Company.

• Construction of Du Pont Plaza Architectural and Construction Industries Center, located in downtown Miami, Fla., is planned to begin in October, 1954 and is slated for completion and formal opening in December, 1955. The $10-million project will be the largest permanent exhibition of building materials in the world. Displays of the Architect's Samples Bureau exhibits will occupy 75,000 sq ft of floor areas, on three terraced levels.

• Worthington Corporation is moving its entire reciprocating power pump operation now handled at the Harrison, N. J. works, to its Oil City plant. Reciprocating steam pumps will continue to be manufactured at the Harrison works.

• Refrigeration Engineering, Inc. has announced the election of new officers and directors. H. T. Jarvis, formerly vice president and general manager, has been elected president and chairman of the board of directors. D. D. Wile, formerly chief engineer of Recold, becomes vice president and a director. E. V. Jarvis has been elected secretary-treasurer and a director to complete the top management group.

• Paul K. Addams of New York City was re-elected President of the Oil-Heat Institute of America at its thirty-second annual meeting in Philadelphia. Mr. Addams is president of the Fitzgibbins Boiler Co., Inc., New York, N. Y.

• Chrysler Airtemp has established 15 new air conditioning compressor rebuilding stations in key service areas. Depending on available stock, the station will either replace or repair a returned compressor.

• For the past eleven years Ralph A. Patterson has been general sales manager for Bell & Gossett Company, Morton Grove, Illinois, manufacturers of heating and cooling equipment. He is now being moved up to vice-president and will transfer to New York City where he will establish a new Bell & Gossett office.

• The board of directors of The Lincoln Electric Co., Cleveland, Ohio, elected William Irrgang president and general manager of the company. James F. Lincoln, elected chairman of the board, will remain active in the direction of company policies. John C. Lincoln, founder of the company, was elected honorary chairman of the board and treasurer. Other officers elected were John S. Roscoe, executive vice-president; A. F. Davis, vice-president and secretary; George Landis, vice-president. Irrgang becomes the third president in the 59-year history of the company. He has been executive vice-president since October, 1951.

• James W. Hosler has been elected vice president of the Industrial Unit Heater Association. Mr. Hosler is the manager of the merchandise department of the American Blower Corp. His background of engineering and sales work with architects, engineers, industrials and contractors will be most helpful to the association's marketing and engineering programs.

• Theodore Skoglund, product promotion manager for residential air conditioning, has been promoted to the newly-created post of director of sales training, Unitary Equipment Division, Carrier Corporation. A veteran of 16 years in the air conditioning business, Mr. Skoglund began his career as a salesman, and was president and sales manager of his own distributing company in Westchester County, New York, before coming with Carrier in 1953. Mr. Skoglund's duties in residential sales promotion will be taken over by Theodore F. Preston.

• Richard H. Heilman has been appointed general traffic manager of the A. O. Smith Corp. to fill the vacancy created early in June by the death of Alfred H. Zastrow. A native of Sturgeon Bay, Wis., Mr. Heilman joined the A. O. Smith traffic department in 1938. Warren Hendricksen has been named to fill the newly-created post of general sales manager of the company's Process Equipment Division. He was head of sales for the pressure Vessel Dept. of the Division since 1953 and in the preceding decade had been connected with the same type of sales engineering in the New York District offices of the company.

• The Research Committee of the National Association of Plumbing Contractors has announced a program that enables promising college graduates to continue their education for their own benefit and that of the industry. The program is a joint venture of the NAPC and Crane Co. Launched at the request of the NAPC Research Committee, the program has resulted so far in two Crane Fellowships to the University of Iowa.

WARREN WEBSTER & CO.

Announces a New WEBSTER-NESBITT Series C Unit Heater *that has everything!*

A deluxe line of cabinet heaters in five basic sizes, with steam or hot water heating element and two or more centrifugal fans . . . offering attractive styling, high capacity, and extreme flexibility of application.

WEBSTER-NESBITT SERIES C UNIT HEATERS remove practically every obstacle to your freedom of design and application in heating offices, showrooms, corridors, etc.

The family of five matched casings ranges in length from 34″ to 74½″. Heights are 22¾″ (for the small unit, Type B) and 29″ (for the four Type D units). For floor mounting, a 2″ base is provided. Three types of front are offered: *universal,* for fully exposed application; *semi-recessed,* for two depths of partial recess; and *fully-recessed.* The recess fronts extend beyond and conceal the rough wall opening.

Hence, Series C units may be installed in a variety of ways: floor-mounted, horizontal, wall, or inverted, and non-recessed, partially-recessed (two depths), or fully-recessed. Additional latitude comes of the fact that, with the universal front, the intake and the discharge can be through the face, the bottom, or the top of unit. Rear intake is available in floor mounting.

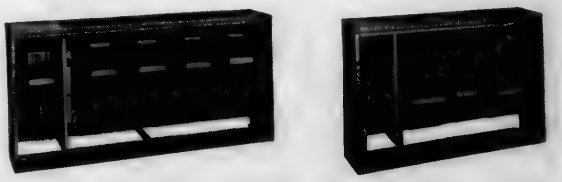
Once again the engineering, manufacturing and distributing facilities of the two great leaders in the heating field bring you equipment unsurpassed for beauty and construction, ease of application, and quiet, dependable performance.

Ask for Publication WN-136.

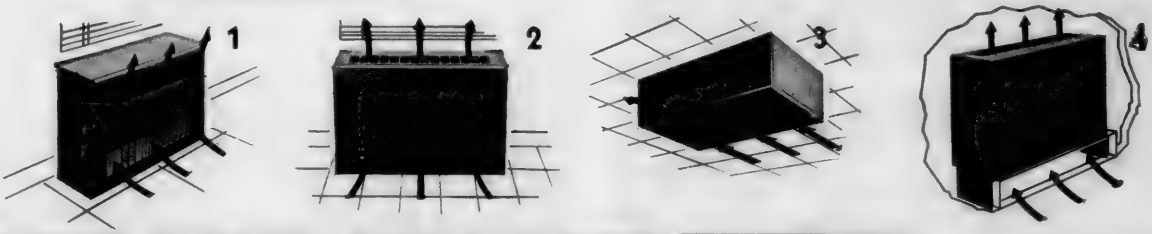
Heating elements are serpentine type, with round seamless copper tubing expanded to plate type aluminum fins. Elements are of two capacities for use with steam; one capacity for use with hot water.

Fans are forward-curved, double-inlet type, designed with their housings for large air volume at low tip speeds. The small unit, Type B, has two fans; the four larger units, Type D, have two, three, four, five fans.

Motors are resilient-mounted and constant speed (standard). Type B motors are 1725 rpm with a variable-pitch motor sheave (two-speed motors, optional). Type B are direct drive; Type D are belt drive.



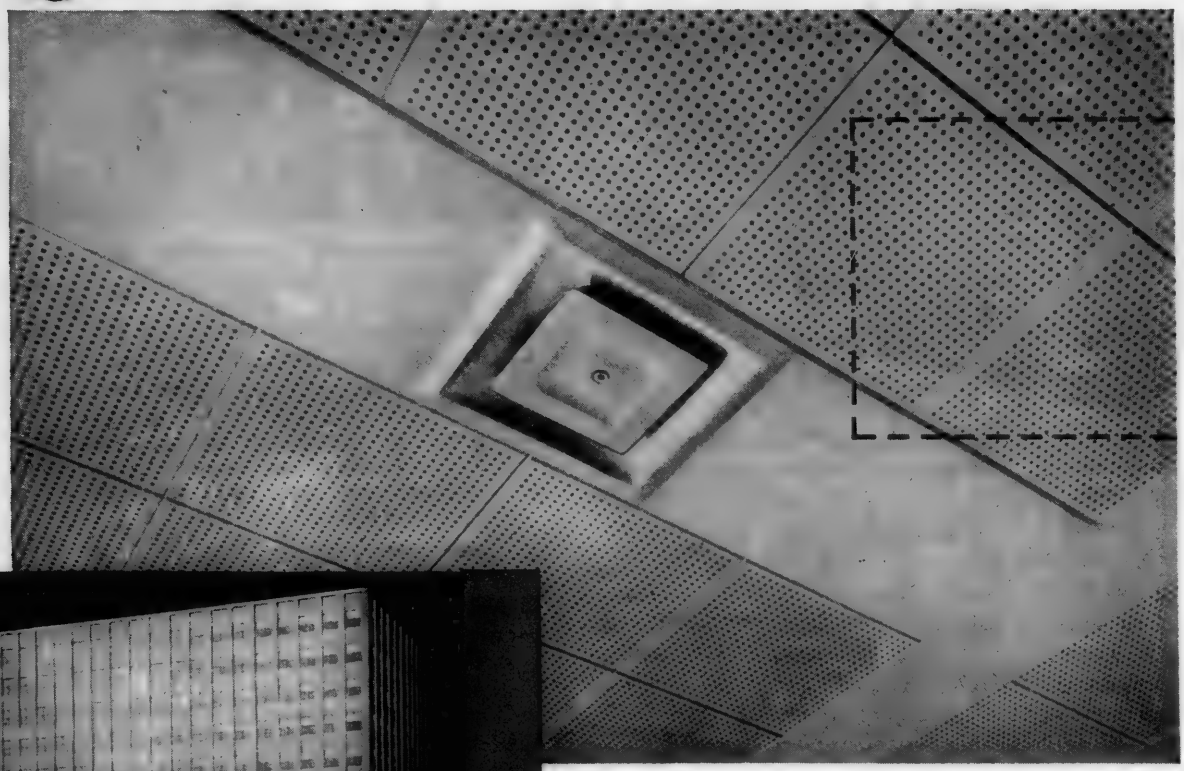
Above: *left,* Type D, draw-through; *right,* Type B, blow through. Below: (1) face intake, discharge; (2) face intake, top discharge; (3) bottom intake, top discharge; (4) rear intake, top discharge.

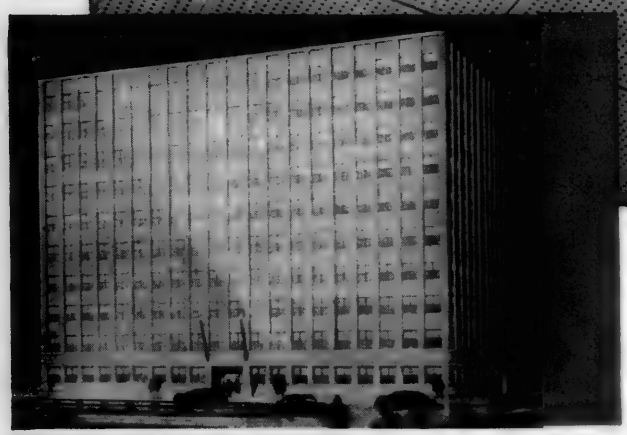


WEBSTER-NESBITT SERIES C UNIT HEATERS

are Manufactured by John J. Nesbitt, Inc., Philadelphia 36, Pa.
and Sold by Warren Webster & Co., Camden 5, N.J. with offices in principal cities

Now... made to be integrated





HOLABIRD & ROOT & BURGEE • ARCHITECTS

BASIC BEAUTY of the ceiling is accented by the Kno-Draft Panel Type Air Diffusers, which blend into the ceiling pattern and create a single unified surface that is absolutely level and pleasing to the eye.

SINCLAIR OIL COMPANY'S new modern 12-story building in Chicago. Acoustical ceilings with integral Kno-Draft Panel Type Air Diffusers are used throughout.

EASY TO INSTALL as the acoustical tiles themselves, Kno-Draft panels snap quickly into place. Ducts and flexible connections are readily accessible and connections can be made in a matter of minutes.

FLEXIBILITY of location is a big feature of Kno-Draft Panel Type Air Diffusers. Flexible connections permit diffuser panels to be offset from ducts. This allows partitions, offices, display areas to be relocated without moving ductwork.

with your acoustical ceilings...

kno·draft®

PANEL TYPE air diffusers

These handsome, efficient Kno-Draft Panel Type Air Diffusers are especially designed for use with suspended acoustical ceilings, and can be moved anywhere on the ceiling to meet changing conditions of occupancy. They benefit everyone—

Architects can specify handsome, low-cost ceilings with completely integrated air diffusers and lighting units.

Consulting engineers have a welcome flexibility in design and avoid the exact calculations imposed by fixed outlets and rigid connections.

Sheet metal contractors save a lot of installation time and labor. Kno-Draft Panel Type Air Diffusers go up faster than any others.

Building maintenance engineers always have quick access to the concealed service lines, air ducts and wiring.

Owners enjoy the comfort of perfect air diffusion and can relocate diffusers and lighting units easily to meet demand changes.

Kno-Draft Panel Type Air Diffusers are available in 12" x 24" and 12" x 48" panels and three outlet sizes to handle up to 175 c.f.m. Diffusers can be easily adjusted *after installation* to regulate air volume without affecting air velocity which remains constant. No air "spillage" at *any* damper position.

For complete specifications and engineering data, mail the coupon today. Connor Engineering Corporation, Danbury, Connecticut.

COMPLEX BENDS to connect diffusers to ducts may sometimes be necessary. They can be easily made by taking off from side of duct. Special connectors are practically indestructible, will not support combustion, and maintain a uniform interior cross section at all times. They do not contribute to noise level.

DAMPER ADJUSTMENT to control air volume can be made quickly and easily *after installation.* Exclusive Kno-Draft sleeve type damper regulates volume without affecting air velocity.

CONNOR

kno·draft®

panel type air diffusers

see our catalog in ARCHITECTURAL FILE or write for copy

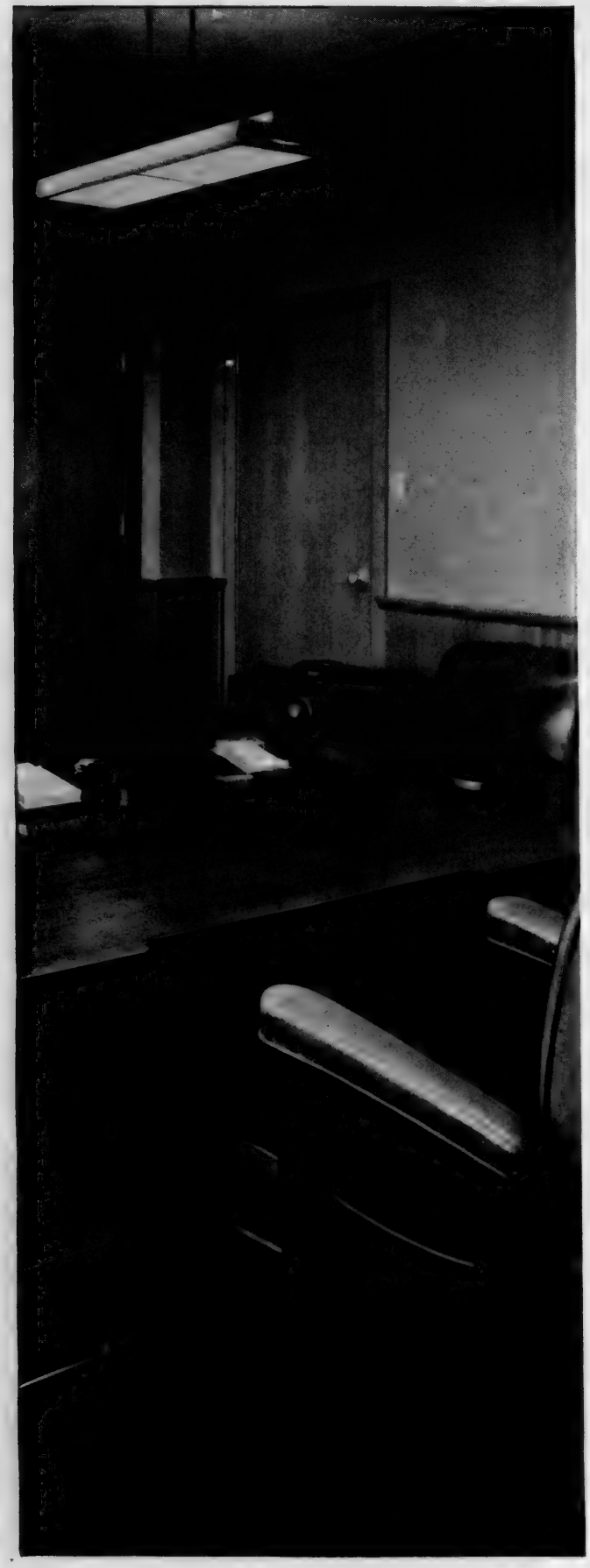
CONNER ENGINEERING CORPORATION
Dept. J-84, Danbury, Connecticut

Please send me, without obligation, full information on your new Kno-Draft Panel Type Air Diffusers.

Name_____

Company_____

Address_____



How Honeywell Customized Temperature Control can help you

Assure your clients ideal Indoor Weather –the year round

Honeywell Customized Temperature Control is becoming a "must" in all types of buildings

IF all the air conditioning and ventilation duct-work in the new home office of the Allstate Insurance Company in Skokie, Illinois, were laid end to end, it would make a tunnel 2½ *miles long.*

Which is by way of saying how important ideal Indoor Weather is at Allstate–for hundreds of employees handling the affairs of 2,500,000 policy holders.

Another important part of the Indoor Weather installation in Allstate's new home office is the *Honeywell Customized Temperature Control* installation, which controls both heating and cooling.

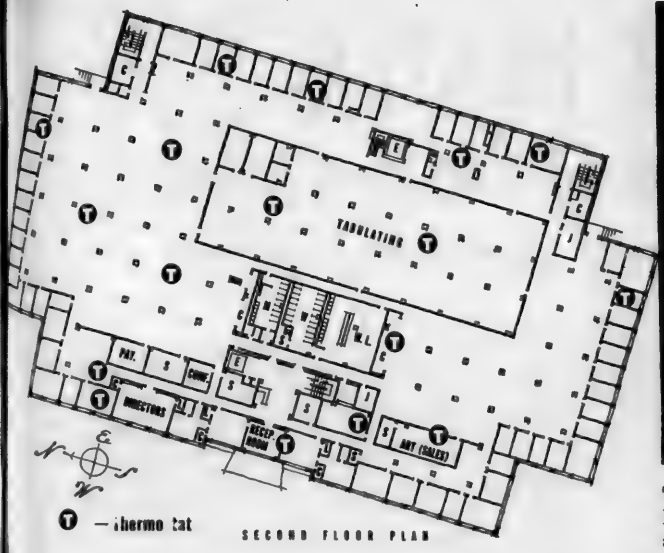
The story, in brief form, of the Honeywell Customized Temperature Control installation in Allstate's new home office is told by the pictures and captions on these two pages.

The *techniques* used, applied to your particular problems, can help you give clients the Indoor Weather they've always wanted–customized to their requirements.

The key word here is "customized." It means that whatever your clients' control requirements, a Honeywell Customized Temperature Control installation *designed to fit the needs of the building and its occupants* is your answer. This applies not only to heating and cooling, ventilating and humidity control but to industrial control as well.

Only Honeywell can provide a truly "customized" control installation. Because only Honeywell manufactures all three types of controls–pneumatic, electric and electronic.

The executive who occupies the office at left likes to work in temperatures that are cooler than average. This atmosphere he can have, because the office is equipped with its own thermostat. Individual office temperature control is an important feature of Honeywell Customized Temperature Control.



The new home office of the Allstate Insurance Company in Skokie, Illinois, is a three-story building of some 184,750 square feet. Large glass areas face all four directions. Yet with Honeywell Customized Temperature Control on the job, *comfort* is uniform throughout the building—all the time. Architects and engineers were Dunlap and Esgar, Inc., Chicago. Consulting mechanical engineer was William Goodman, Chicago.

For comfortable, even temperature in new or existing buildings—of any size—specify Honeywell Customized Temperature Control

Whether it's an office, school, shopping center, factory, motel, hospital—or any size building—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

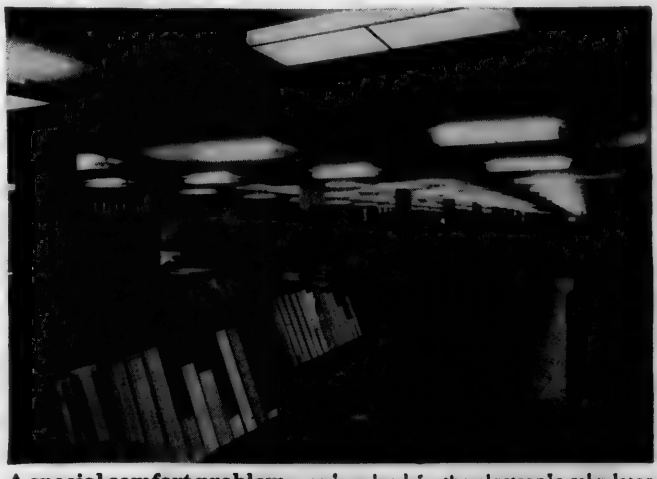
They will not only enjoy more comfort and efficiency, they'll save fuel, too.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. Or mail the coupon today.

William Goodman, consulting mechanical engineer, says:

"Providing ideal Indoor Weather the year round sometimes gets to be quite a job. I'm sure glad to have Honeywell Customized Temperature Control available to help do the right kind of job."

The comfort problem in large office areas is quite different from what it is in the relatively small private office. More people are involved, the much greater area itself is important, exposure factors are heightened. In the area pictured above (located at left in the floor plan) three thermostats were needed to provide perfect comfort in all kinds of weather.



A special comfort problem was involved in the electronic calculator room above. On the floor plan it's that separate area labeled tabulating. Calculating machines, because of the way they work, just naturally give off heat. But this needn't cause discomfort—not with Honeywell Customized Temperature Control on the job. The right number of thermostats, strategically placed, insures perfect comfort at all times.

MINNEAPOLIS
Honeywell

112 OFFICES ACROSS THE NATION

First in Controls

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
Dept. HV-8-145, Minneapolis 8, Minnesota
Gentlemen: I'm interested in learning more about Honeywell Customized Temperature Control.

*Name*_____

*Firm Name*_____

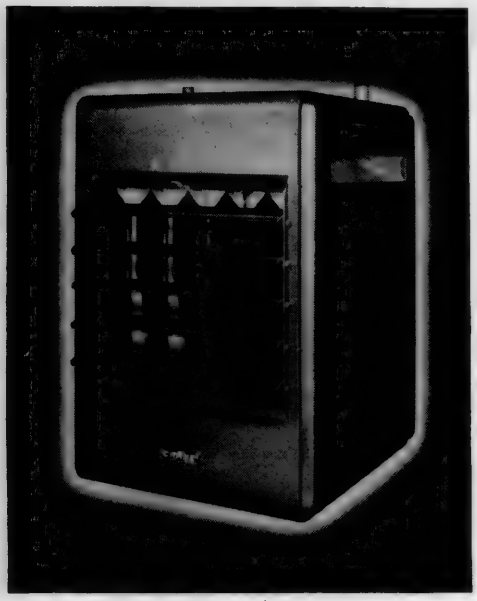
*Address*_____

*City*_____ *Zone*____ *State*_____

CRANE UNIT HEATER

. . . opens the door to high-profit commercial heating installations

Ideal unit for stores, factories, offices—Ideal for modernization and expansion jobs



Here's the way to get more of that profitable commercial heating business. Crane 4UH Unit Heater, used singly or in combination, can meet a great variety of heating needs. Off the floor and out of the way, it is ideal for stores, offices, warehouses, factories, service stations and garages.

This automatic, gas-fired unit heater provides quiet, thermostat-controlled heat when and where it is needed. There's no waste fuel in warm-up and stand-by time, no costly boiler room and piping system, no fuel handling. Input ratings from 50,000 to 225,000 Btu.

Crane offers complete line

Crane heaters and boilers come in every size, for every kind of fuel and heating system. Line up with Crane, and you're lined up to handle *any* heating installation. Get full details today from your Crane Branch or Crane Wholesaler.

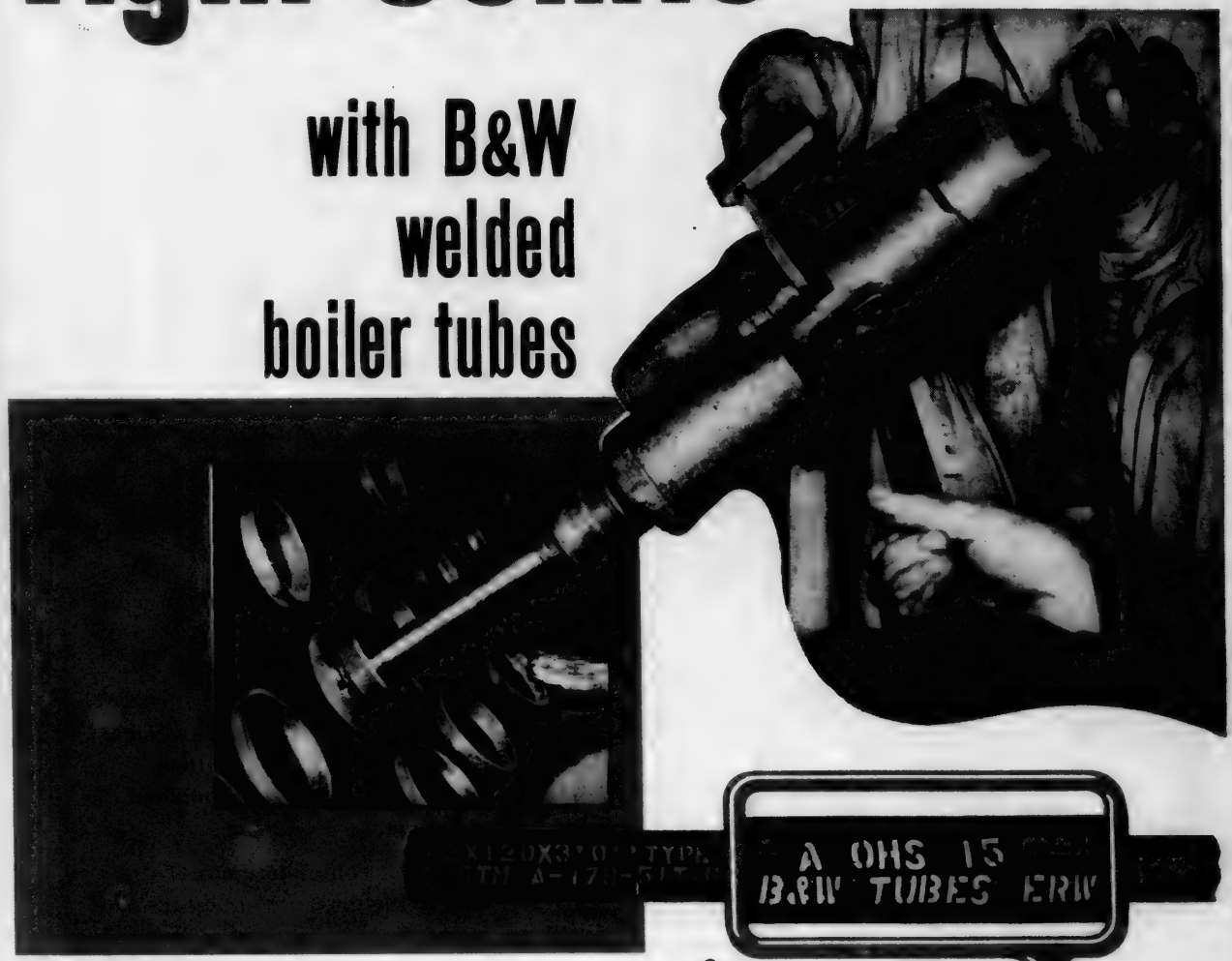
CRANE CO.

GENERAL OFFICES: 836 SOUTH MICHIGAN AVE., CHICAGO 5
VALVES . . . FITTINGS . . . PIPE . . . PLUMBING AND HEATING

you get

Tight Joints

with B&W welded boiler tubes



A combination of qualities are offered by B&W Electric Resistance Welded Boiler Tubes that add up to savings in time, money and labor. The surfaces are free from pits, indentations, mill scratches and similar imperfections. Because of controlled normalizing practice, the surface is protected against formation of detrimental scale. This freedom from detrimental scale combined with uniform size and mechanical properties guarantees ease of "rolling in" and produces the tightest possible joint.

For three-quarters of a century, B&W has been directly concerned with developing and applying boiler tubes for all pressures up to those approaching 3000 psi. The application of this extensive knowledge and experience results naturally in the production of finer welded boiler tubes.

If you want ease of fabrication and long service life for the tubing in your boiler—specify B&W ERW Boiler Tubes.

LOOK FOR THIS

—wherever fine boilers are operating efficiently over extended periods.

To meet the specifications of time; say B&W before you say WELDED BOILER TUBES— for service-proved dependability.

TA-4028(CWP)

B&W SEAMLESS and WELDED TUBES

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing

Introducing the NEW... Barkow

"O" CEILING MODEL AIR CONDITIONER

. . . for residential and commercial use . . . ideal for attic installation — Attach it to existing Warm-Air Ductwork or use as self-contained unit for Free Discharge.

It's up off the floor . . . completely out of the way . . . can be placed in the most advantageous spot and still not interfere with home or store traffic; does not occupy expensive floor space.

Yes sir, the new Barkow model "O" opens a tremendous market of residential, commerical and industrial users . . . people who heretofore found it impractical to consider air conditioning due to a lack of space. Now they and you can benefit from this space-saving, economical unit. Available in two and three ton sizes with or without blower.

Check These BARKOW Features:

- ✓ HERMETICALLY SEALED COMPRESSOR
- ✓ INEXPENSIVE THROW-AWAY FILTERS
- ✓ COMPLETE PACKAGED UNIT
- ✓ EASY TO INSTALL—EASY TO SERVICE
- ✓ ALL PARTS ACCESSIBLE FROM FRONT PANEL
- ✓ USES FREON 22 REFRIGERANT
- ✓ EXCEEDS RATED CAPACITY

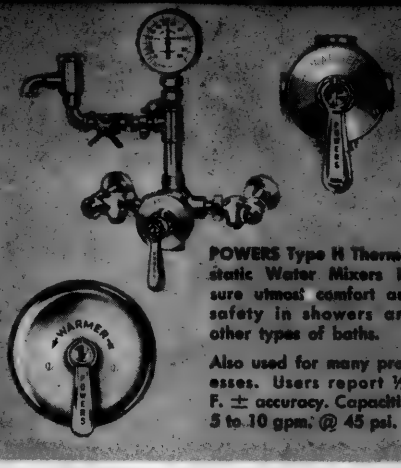
DISTRIBUTORS, ***Wire or write for details***

refrigeration division

Aug. G. Barkow Mfg. Co., Inc.

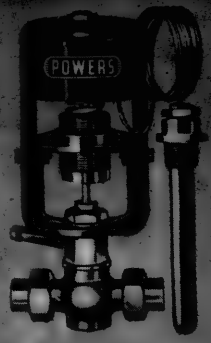
2230 South 43rd Street Milwaukee 15, Wisconsin

Above: POWERS ACCRITEM Temperature Regulator, is water or compressed air operated. Controls FLOWRITE diaphragm valve (right). Widely used for Water Heaters and Industrial Processes.



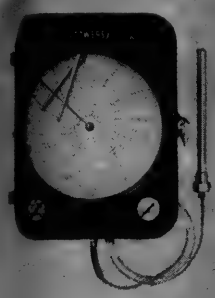
POWERS Type H Thermostatic Water Mixers insure utmost comfort and safety in showers and other types of baths.

Also used for many processes. Users report ½° F. ± accuracy. Capacities 5 to 10 gpm. @ 45 psi.



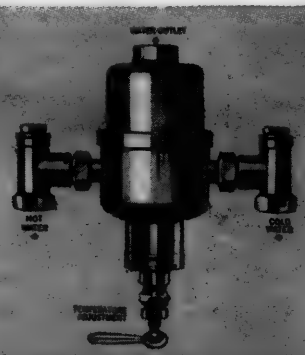
Powers No. 11 Self-Operating Regulator widely used for water storage heaters, heat exchangers, fuel oil preheaters and many industrial processes.

WATER Temperature CONTROL?

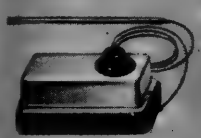


Powers Series 100 Recording Controller. Compressed Air Operated.

POWERS FLOWRITE V-Port-Characterized Diaphragm Control Valve.



Powers Thermostatic Water Controller for regulating temperature of multiple type showers, hydro-therapy and industrial processes. Capacities 22 to 125 gpm. @ 45 psi.



Powers Remote Bulb Type D Thermostat for Unit Air Conditioners.

POWERS PACKLESS VALVES

For controlling chilled, or heated water in unit air conditioners.
No leakage
No packing maintenance

Call POWERS

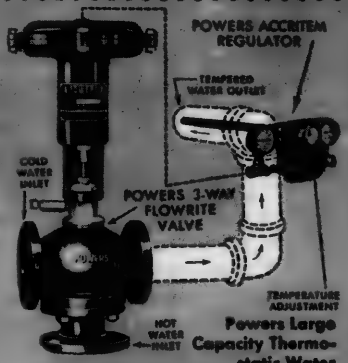
Most Complete Line of Controls Made Only a few are shown here

for All Types of Baths, Water Heaters and Heat Exchangers

- Forced Hot Water Heating Systems
- Radiant Panel Heating Systems
- Air Conditioning Units using Chilled and Heated Water
- Cooling Water for Air Compressors, Diesel, Gas Engines, and Cyclotrons
- **Many Industrial Processes:** Photo Developing, X-Ray, Color and Ordinary Film, Lens Polishing and Grinding, Chocolate Enrobers, Plastic Molding Presses, etc.

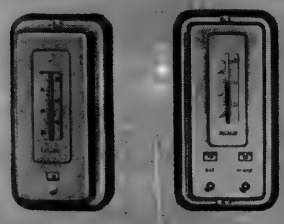
Our More than 60 Years Experience will be valuable in helping you select the right control for your requirements. Contact our nearest office or *Write us direct for Condensed Catalog Rb 24.*

THE POWERS REGULATOR CO.
Skokie, Ill. • Offices in Over 50 Cities in the U.S.A., Canada and Mexico



Powers Large Capacity Thermostatic Water Mixing Valve Controlled by an ACCRITEM Temperature Regulator. Capacities 20 to 1200 gpm. @ 45 psi.

Powers MASTROL Control for regulating forced hot water heating systems.

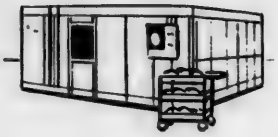


Powers Room Type Pneumatic Controls for Radiant Heating-Cooling Panels, Convectors and Unit Ventilators. Valves are packless. No more packing maintenance. No leakage.

(b

Curtis Refrigeration and Air Conditioning

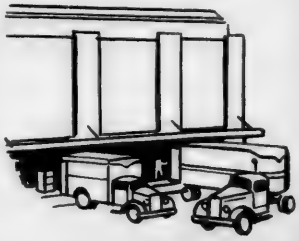
Gives You More Jobs to Sell...



Processing

Locker Installations

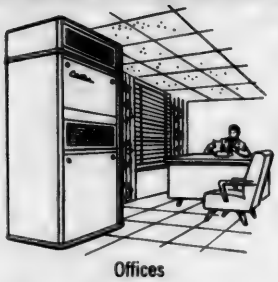
Cold Storage Rooms



Food Warehouses

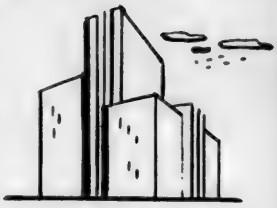
ALL KINDS OF REFRIGERATING JOBS

Homes



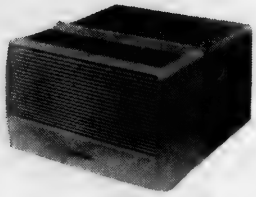
Offices

Businesses

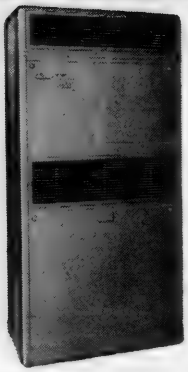


Large Buildings

AIR CONDITIONING JOBS—BIG AND SMALL

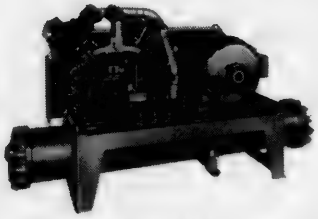


Room Air Conditioners

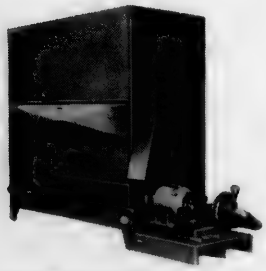


Packaged Air Conditioners
2 to 10 tons

Combination Heating-Cooling Units



Condensing Units up to 80 Tons



Evaporative Condensers,
Cooling Towers,
Matching Air Handling Units

When you handle the Curtis Line, you're ready for practically any profitable job in the field of air conditioning and refrigeration. You're ready to satisfy customers with the industry's top quality equipment line. You're ready to take advantage of Curtis' national advertising in *Saturday Evening Post, Time, Newsweek* and other well-read publications.

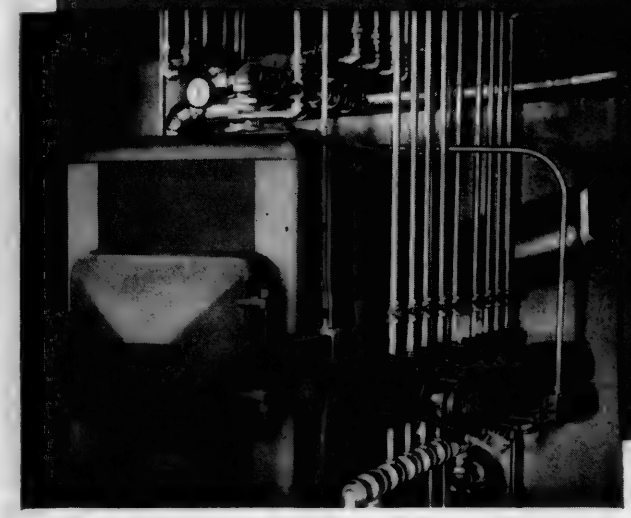
It makes profit sense to sell Curtis. To learn if you qualify for a direct factory franchise, write on your company letterhead.

1856 **100** 1954
years
OF SUCCESSFUL MANUFACTURING EXPERIENCE

Curtis REFRIGERATING MACHINE DIVISION
of Curtis Manufacturing Company
1999 Kienlen Avenue, St. Louis 20, Missouri

809

EVERY TENANT HIS OWN WEATHER-MAKER



Nine B & G Boosters, individually controlled by room thermostats, circulate hot water to each zone.

B & G Flo-Control Valves, installed in the supply mains, prevent an override in temperature when the Boosters shut off.

For QUIET operation and long, trouble-free life, you can depend on the B & G Booster. Send for Bulletin DG-950—see the reasons why this pump is the biggest seller in the field.

Some like it warm, some like it cool...but in this apartment building, B & G *Hydro-Flo* Heating keeps everybody happy. Each tenant can have the temperature considered most comfortable—*and raise or lower it at will!*

The building is divided into nine zones, each equipped with a thermostatically controlled B & G Booster and a B & G Flo-Control Valve. Economy of operation as well as comfort is achieved, since zoning permits compensation for differences in exposure, solar effect and temperature preference.

When you install a B & G *Hydro-Flo* Forced Hot Water System, you've laid the groundwork for the most modern comforts and conveniences. You've provided better heating ...uniform temperature—warm floors—draftless rooms. You've assured fuel economy and the convenience of low-cost, all-year domestic hot water. Snow-melting and summer cooling equipment can be added at any time.

Send today for catalog of B & G *Hydro-Flo* Products.

BELL & GOSSETT
COMPANY

Dept. DN-4, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

*Reg. U. S. Pat. Off.

NOW! Full unit control in ...with Trane UniTrane

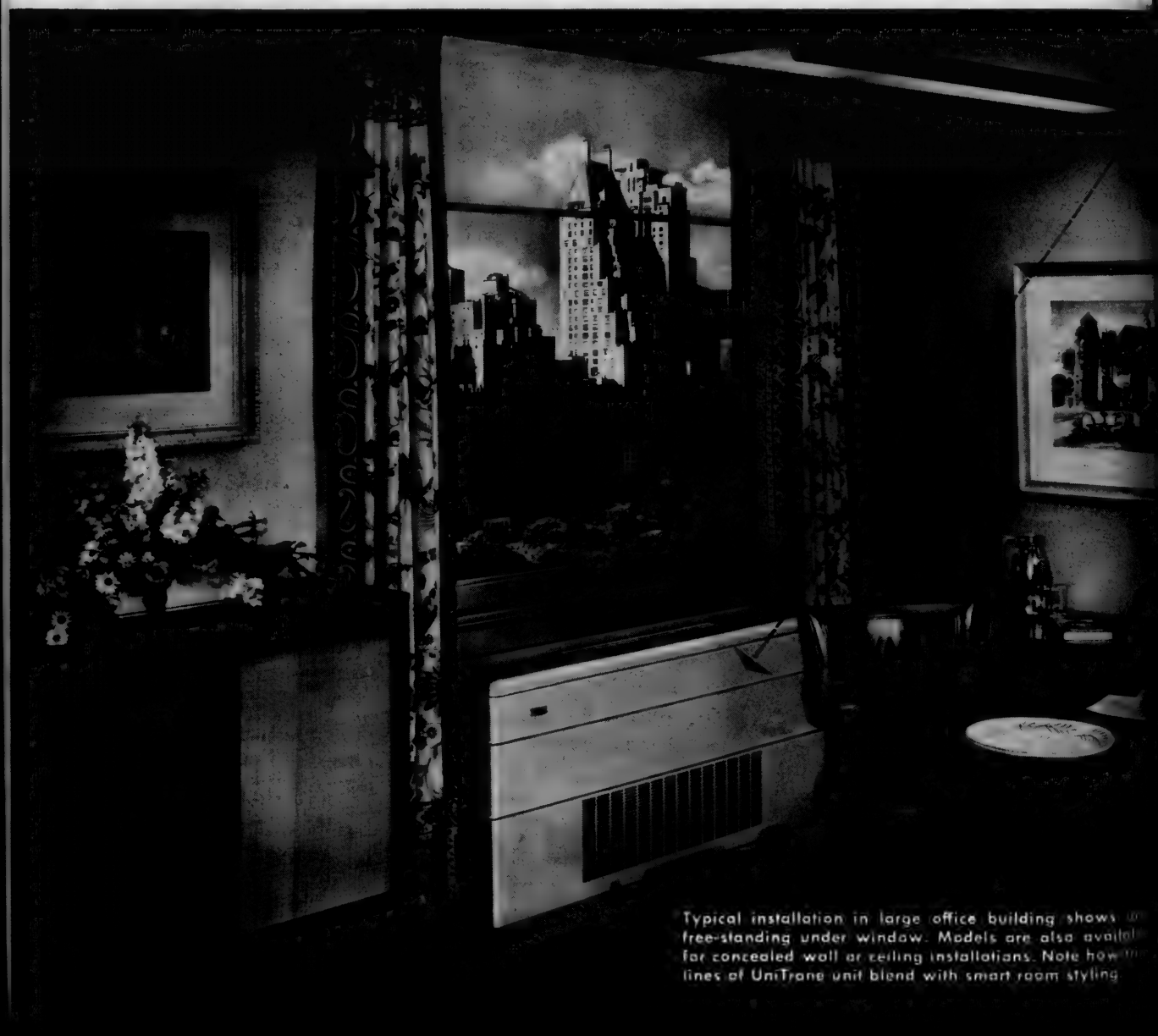
Each tenant dials his own climate with this air conditioning system. This is UniTrane! And UniTrane means *full unit control* in multi-room air conditioning. It's the system that offers all the desirable features of a central system . . . *plus* individually-controlled room units that cool or heat, dehumidify, ventilate, filter and circulate air for *personalized* climate control.

UniTrane meets widely varied demands—from large office buildings, hospitals, hotels and commercial buildings down to small apartments and motels. Because, with UniTrane, each tenant sets the temperature of his room just as *he* wants it, *without affecting the temperature or "climate" of any other room.* Tenants prefer it.

Management agrees UniTrane offers more. This unique combination of tenant advantages costs less to install, far less to operate. The same piping circuit is used for *both* heating and cooling. Individual room units can be shut off in unoccupied rooms without affecting operation of any of the other units. Operating load can be matched directly to fluctuating temperature requirements for lowest possible operating costs.

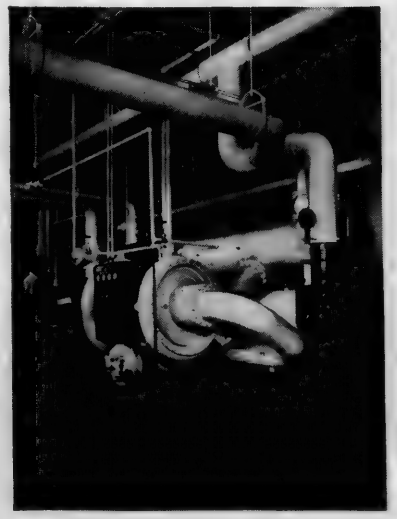
Architects especially like the savings in valuable floor space, the design freedom. Units are available in all sizes and types —free-standing, recessed, semi-recessed, ceiling—for either exposed or concealed installation.

Discover for yourself just how easy it is to offer full *unit control* in multi-room air conditioning—with central system economy! Contact your nearest TRANE Sales Office or write TRANE, La Crosse, Wisconsin, for Bulletin DS-420B.

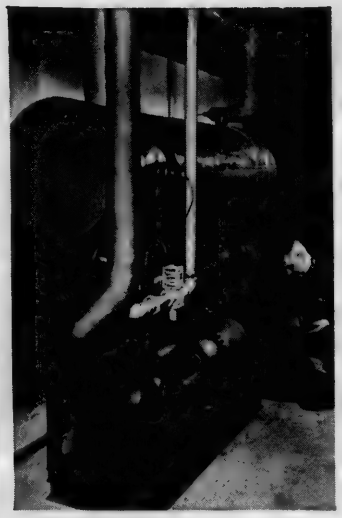


Typical installation in large office building shows free-standing under window. Models are also available for concealed wall or ceiling installations. Note how the lines of UniTrane unit blend with smart room styling.

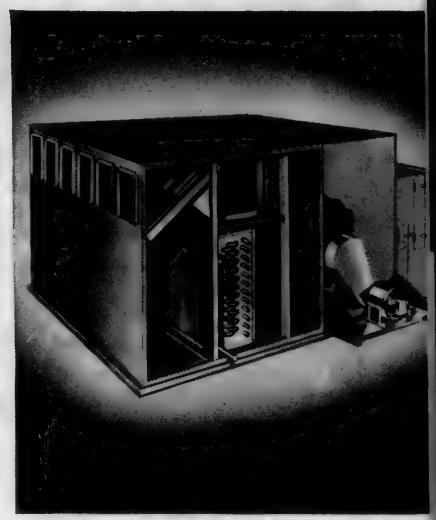
multi-room air conditioning Units



Trane CenTraVac supplies chilled water for UniTrane and TRANE Climate Changer units in large systems. Starts, stops, modulates automatically, with power consumption in almost direct proportion to load. Eight models, 45 to 400 tons.



Trane Cold Generator for smaller installations using UniTrane units or TRANE Climate Changers, or both. Delivers chilled water from one compact package. Engineered, built, tested and refrigerant-charged at the TRANE factory. 10 to 100 tons.



Trane Multi-Zone Climate Changers are air handling units which can heat, cool, humidify, dehumidify, ventilate and filter air (singly or in combination) for as many as *six* different zones at once. 28 models, 450 to 23,400 cfm.

In six of New York's newest skyscrapers TRANE Custom-Air systems are installed. The Custom-Air system utilizes UniTrane room units combined with a central source of ventilation air to give complete air conditioning comfort plus individual tenant control of room temperature. Installations include 99 Park Ave.; 579-589 Fifth Ave.; 7 Park Ave.; 261 Madison Ave.; 720 Fifth Ave.; 460 Park Ave.

one source • one responsibility

Specify TRANE UniTrane Units

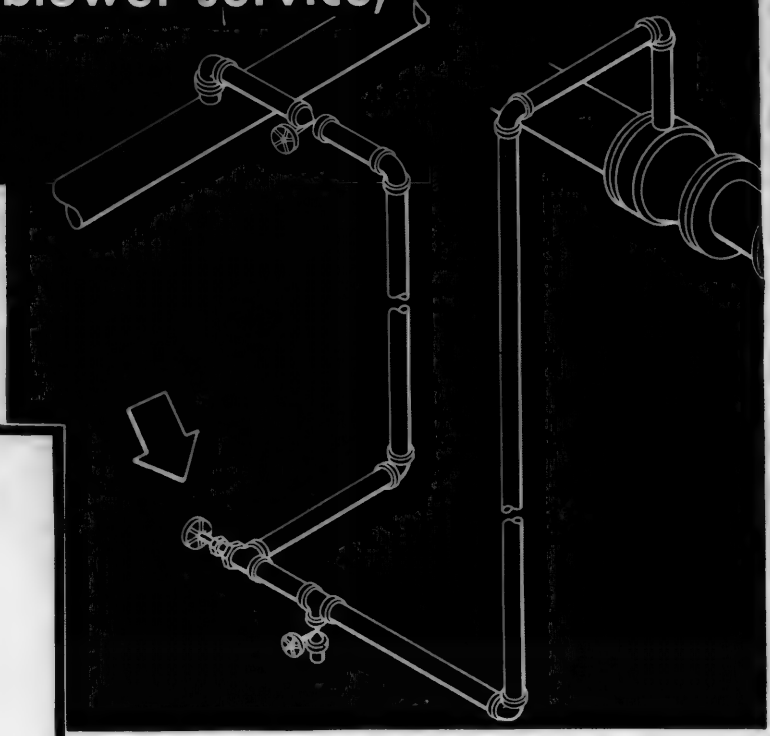
for personalized climate control

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATION AND HEAT TRANSFER EQUIPMENT

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto
90 U.S. and 15 Canadian Offices

Single Valve Saving $150 Yearly

. . . on severe ash blower service, for example . . .



The Installation

At City Light & Power Company, Washington, Indiana—with Crane bronze angle valve in 2-inch steam line to boiler ash blower manifold. Working pressure: 300 psi, 525 degrees F.

Valve Service Ratings

SUITABILITY:
Perfect match for needs

FEATURES:
Crane Plug Type Disc

MAINTENANCE COST:
One stem replaced in 3 years

SERVICE LIFE:
Already 12x former valves

OPERATING RESULTS:
Over $400 saved to date

AVAILABILITY:
Crane catalog item—No. 384P

The Valve

Crane plug-type disc and seat design make a most effective seating combination for tough steam service. Highly resistant to damage by foreign matter, wire-drawing, erosion, cutting, galling, etc. The wide tapered disc allows fine, accurate throttling. These rugged bronze valves come in globe and angle patterns; see your Crane Catalog or Crane Representative.

The Case History

Valves formerly had to be replaced every 8 to 12 weeks, their cost alone exceeding $150 yearly. It's a tough spot even for a good valve.

The valve's location in the steam line is below the boiler water level. Each operating cycle exposes it to a long leg of condensate, with an abrupt change to hot steam direct from the boiler header. On closure, the valve is again subject to cooling, and that's the cycle about 8 times daily.

Under those conditions, this Crane No. 384P Bronze Plug Type Disc Angle Valve put a stop to former replacement cost, saving more than $400 in 3 years since installed. Still the valve remains tight, dependable, and fully fit for service. That's the result of choosing the right valve—the choice assured by Crane quality and the completeness of the Crane line.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Propeller type ventilating fans deliver large volumes of air at low resistance and low current consumption. All wheels are machine balanced for smooth, vibrationless operation. Made in 2 types and 10 basic sizes to cover a wide range of industrial applications. Pressed steel panels provide rigid support and simplify installation. Totally enclosed motors mounted in heavy welded wire safety guard. Wheel diameters from 10 inch to 48 inch. Direct or belted drive. Capacities from 610 cfm to 24,200 cfm. Penthouses for roof installation of ***nyb*** Propeller Fans can be furnished in 6 sizes. Louvers open and close automatically to protect fan against the weather. Separate louvers for wall mounting also available.

Write for Bulletins

IUHA HEAT WITH UNIT HEATERS

SEE OUR CATALOG IN SWEET'S

CERTIFIED RATINGS

All New York Blower Company products are laboratory tested, accurately rated and fully guaranteed in strict accordance with Standard Test Codes.

THE NEW YORK BLOWER COMPANY

SALES OFFICES • 3165 SOUTH SHIELDS AVENUE • CHICAGO 16

FACTORY, LAPORTE, INDIANA

Fountain in the garden of the Student Union.

New Student Union Selects Air Conditioning & Refrigeration

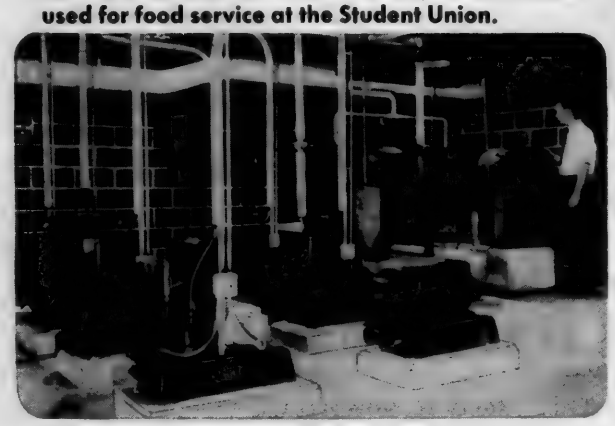
This fine building of the Indiana University Medical Center, at Indianapolis, comprises apartments, guest rooms, dining halls, shops, swimming pools, etc.

Here both air conditioning and food service loads are handled by 13 Frick refrigerating machines, and a Frick unit air conditioner. Seven fractional-horsepower units serve food-dispensing equipment, while four of 7½ horsepower each cool a dozen walk-in boxes. The Frick "ECLIPSE" machines operate a chilled-water air conditioning system. Installation by Hayes Bros., Inc., Distributors at Indianapolis and South Bend.

For that important cooling job of yours, specify Frick equipment: there's nothing to compare with it. Write now for Bulletin 100 on "ECLIPSE" compressors.

The book store, cafeteria, and other public spaces are all air conditioned.

Below: Some of the 11 Frick low-pressure units used for food service at the Student Union.

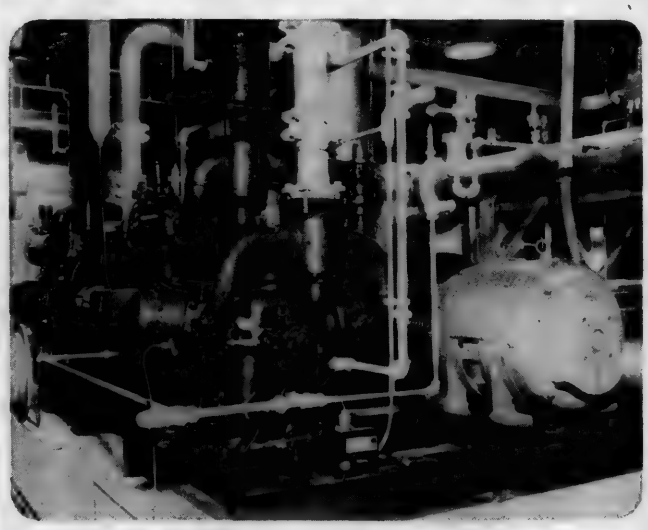


DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery



Two Frick "ECLIPSE" compressors, each with nine cylinders, handle the air conditioning of public spaces in the Student Union at Indianapolis.

"All Through The House"

BUSH BASEBOARD RADIATION

The performance-proven answer to the heating man's needs and the home owner's desires. Economical Bush Baseboard is easy to install . . . tops in efficiency. Trouble-free operation elminates costly "call-backs".

Home buyers like the unobtrusive design which permits full use of floor space, flexibility in furniture arrangement. Bush Baseboard is specifically designed to eliminate "wall streaking" . . . provides uniform temperatures between floor and ceiling.

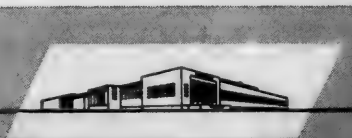
To make your job easier and insure customer satisfaction, plan on Bush Baseboard all through the house.

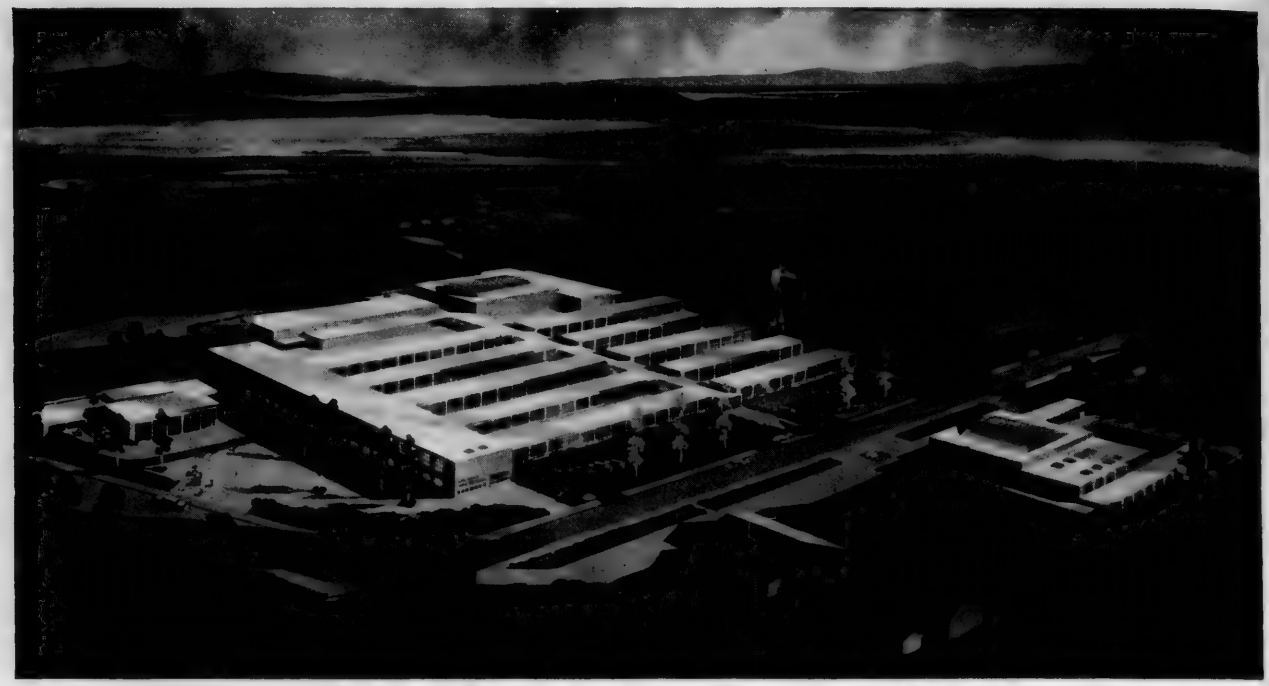
A free illustrated bulletin containing complete information and specifications is available on request.

Bush Baseboard is available in special style for recessed mounting (as shown here) or for flush mounting.

BUSH MANUFACTURING COMPANY

WEST HARTFORD 10, CONNECTICUT





San Jose High School, San Jose, California. Architect—Ernest J. Kump, San Francisco; Consulting Engineer—Garthorne, Buonaccorsi & Murray, San Francisco; General Contractors—Williams & Burrows, Inc., So. San Francisco and Carl N. Swenson Co., San Jose; Heating Contractor—Mehring & Hanson Co., Los Angeles.

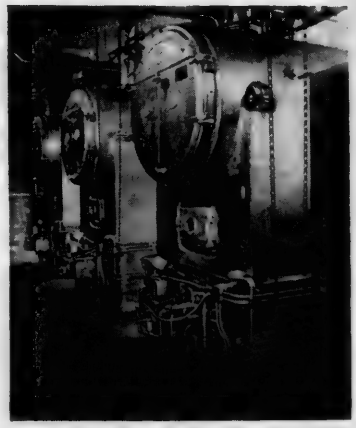
Operating economy assured for schools . . . by Pacific Boilers with Jet-Action Circulation

Beautiful, new San Jose High School, San Jose, California, is radiant heated by three Pacific Boilers—the same boilers that have won the praise of school-building superintendents everywhere for reducing costs of fuel, water and maintenance.

When school-operating reports show unusual economies from a particular piece of equipment, the news spreads fast. In school after school, the proved economy of Pacific Boilers has earned their growing acceptance as "standard equipment."

Pacific's exclusive design and Jet-Action Circulation are responsible for dramatic savings in fuel and water. Jet-Action Circulation is the forceful flow of steam and water through the side connections—jet streams that (1) cause high turbulence, (2) eliminate steam bubble insulation on the tubes, (3) assure maximum heat transfer, and (4) give quick response when temperature changes are needed. Fuel requirements are substantially lower than for other boilers of equal capacities with all types of heating systems, new buildings or old.

If you design new schools, erect them, or install the heating equipment . . . make sure the boilers are as modern as the building itself—call your local Pacific representative for complete information.



In the San Jose High School, these Pacific Boilers provide a flexible supply for floor-type radiant heating in 56 classrooms and the administration area, heating and ventilating units in the locker rooms, and unit heaters in the gym.
Photo courtesy Ray Oil Burner Co.

Designed Constructed and Stamped in Accordance with ASME Code

SBI

PACIFIC Pacific Steel Boiler
DIVISION • UNITED STATES RADIATOR CORPORATION
GENERAL OFFICES: DETROIT 31, MICHIGAN

THESE

YOUNG

ENGINEERED

HEATING COILS

FEATURE . . .

- high efficiency cores
- long life
- guaranteed ratings

TYPE "S" Coils—Standard for steam or water service. Steam pressures from 2 to 150 psi; temperatures to 400° F.

TYPE "SD" Coils—Steam distributing tube type, recommended maximum operating pressure—25 psi.

TYPE "HD" Coils—Heavy duty type for steam pressures up to 300 psi; temperatures to 500° F.

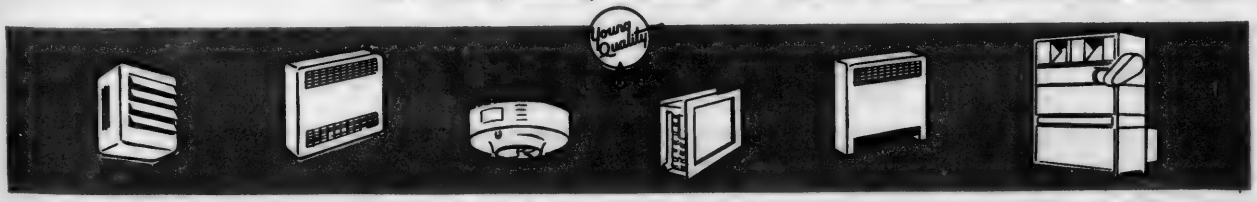
For further details see the yellow pages of your telephone book for nearest Young Sales Representative, or write for free Catalog No. 4553.

Heating, Cooling, Air Conditioning Products for Home and Industry.

YOUNG

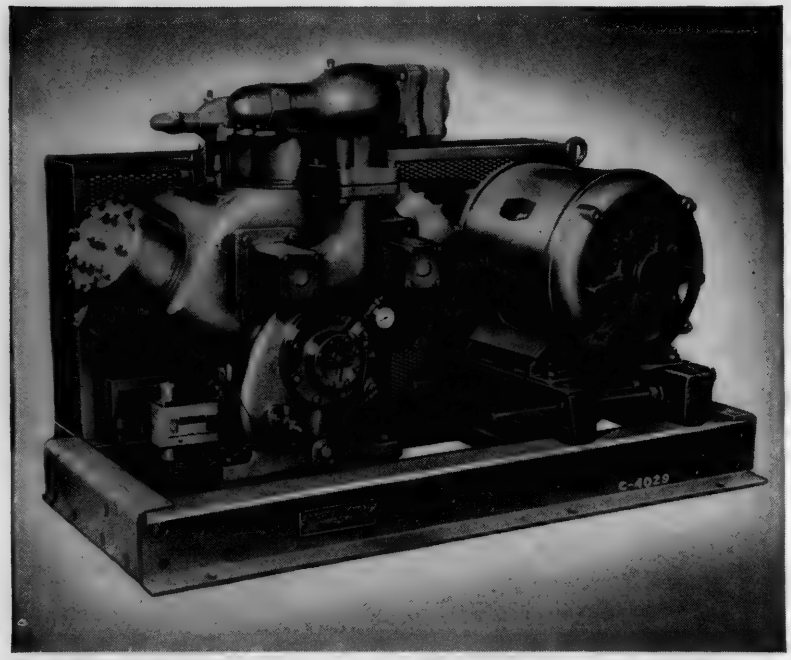
Heat Transfer Products for Automotive, Agricultural, Industrial, Gas and Diesel Engine Application.

YOUNG RADIATOR COMPANY DEPT. 524-H, RACINE, WISCONSIN • PLANTS AT RACINE, WIS. AND MATTOON, ILL.



Horizontal Type Unit Heaters | Cabinet Unit Heaters | Vertical Type Unit Heaters | Heating and Cooling Coils | Convector Radiators | 'YAC' Air Conditioning Units

The whole industry's talking about Worthington's new Freon compressor



TRIM, STURDY CONSTRUCTION marks this 4JF6 compressor unit — 50-60 hp, six cylinder W-type compressor. The complete compact unit consists of fabricated steel base, compressor with valves, gauges and safety controls, drive and safety guard. Designed to operate in conjunction with Worthington evaporative condensers in localities where city water is scarce or high in cost. Also available with shell and tube condenser. Complete range from 3-150 hp.

"The high capacity unit we've been waiting for!"

"Greater operating efficiency!"

"There's nothing else like it!"

And every comment you hear is true! The refrigeration compressor is the most vital element of any air conditioning or refrigeration system. That's why Worthington spent years in developing the new "J" Freon compressor. That's why Worthington invested over a million dollars in compressor research. *And that's why you can't find its match in any other unit.* Only a few features of the new "J" Freon compressor are highlighted here — get the full story by contacting your nearest Worthington district office or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.4.33, Harrison, New Jersey.

EASY REMOVAL of suction gas strainer for cleaning is made possible by new suction manifold design. No pipes, valves or other parts need to be dismantled in order to get at the strainer. And Worthington's new electric unloaders automatically balance power consumption with load requirements.

LORD & TAYLOR'S new West Hartford, Conn., store depends on Worthington to provide comfortable air conditioning for its customers. Two 150 hp "J" compressors and two evaporative condensers make up the highly efficient Worthington air conditioning team at this modern store.

A.4.33

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME

Profit with WEATHERBRAIN

the *completely mechanical* indoor-outdoor control for forced hot-water heating systems

Completely automatic • Inexpensive
No electronic tubes, relays or delicate mechanisms
Easily installed • Assures constant comfort

Now you can cash in on big, new profits in the hot water heating field with Detroit's amazing new Weatherbrain Control. That's because Weatherbrain indoor-outdoor control offers heating comfort never before possible in forced hot-water heating systems—constantly uniform and completely automatic with no manual adjustment required. The Weatherbrain Control's outdoor bulb senses changes in outside temperature and responds instantly by supplying the exact amount of heat to keep room temperature right where it should be! And because it is entirely mechanical in operation with no expensive, complicated electronic circuits, Weatherbrain Control costs less and is easily installed. See your Detroit Controls wholesaler today or write us direct at the factory for bulletin No. 254.

CHECK THESE FEATURES

- Varies the water temperature delivered to panels or radiation in exact accordance with the demands of the weather.
- Good for zone systems due to simplicity and reasonable cost.
- Gradual changes in water temperature in the system minimize the undesirable effects of thermal expansion and contraction.
- Very valuable where more than one type of radiation is used or domestic hot water is heated by the boiler, in which cases the electrical boiler resetting type control can not be used.

DETROIT CONTROLS *Corporation*

5900 TRUMBULL • DETROIT 8, MICHIGAN

Division of AMERICAN RADIATOR & STANDARD SANITARY Corporation

Representatives in Principal Cities • Canadian Representatives in Montreal, Toronto, Winnipeg—Railway and Engineering Specialties, Ltd.

AUTOMATIC CONTROLS *for* REFRIGERATION
AIR CONDITIONING • DOMESTIC HEATING • AVIATION • TRANSPORTATION • HOME APPLIANCES • INDUSTRIAL USES
Serving home and industry

AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS HEATERS • SUNBEAM AIR CONDITIONERS

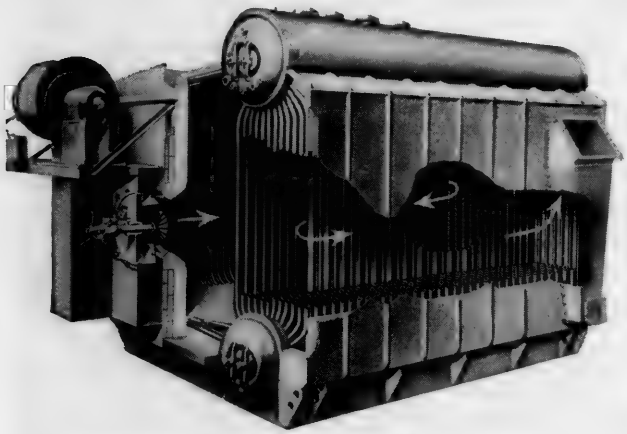
FOR STEAM CAPACITY up to 60,000 POUNDS

Choose your boiler from these two

If you burn oil or gas, investigate the VP Package Boiler for capacities up to 30,000 pounds per hr . . . the VU-10 up to 60,000 pounds.

For stoker firing, the VU-10 is available from 10,000 to 60,000 pounds of steam per hour.

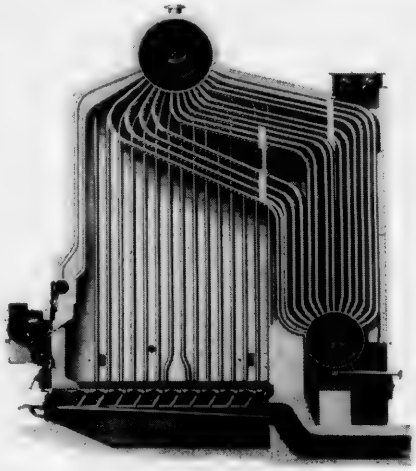
Whatever your fuel . . . whatever your steam capacity requirements up to 60,000 pounds per hour . . . you'll find that one of the Combustion Engineering Boilers described below will be just right for you.



The VP Boiler — the Package Boiler with EXTRA Features

The VP boiler

The C-E Package Boiler, type VP . . . completely shop-assembled . . . for oil or gas firing. It is available in capacities from 4,000 to 40,000 lb steam per hr; for pressures to 500 psi. The VP Boiler has more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. The large (30-in. diameter) lower drum permits a simple, symmetrical tube arrangement . . . greater water storage capacity . . . easy access for washing down or inspection. The centrifugal fan is efficient, yet its noise level is less than half that of typical high-speed blowers used on most package boilers. Baffle arrangement is simple, resulting in low draft loss . . . simple soot blowing . . . elimination of dead pockets . . . high heat absorption.



The VU-10 Boiler, as arranged for C-E Spreader Stoker firing

The VU-10 boiler

The VU-10 Boiler is designed for industrial load conditions, particularly for plants with small operating and maintenance forces. Capacities range from 10,000 to 60,000 lb steam per hr . . . pressures to 475 psi . . . heat recovery equipment is available if desired. Fuel can be either coal (C-E Spreader, Traveling Grate or Underfeed Stoker) oil or gas. This boiler is a completely standardized design adaptable to many conditions. It responds readily to variations in load; it is simple to operate and maintain. All parts are easily accessible for inspection. Like the VP, the VU-10 Boiler is a complete unit — boiler, furnace setting, fuel-burning equipment, controls, forced draft — bringing you the benefit of one contract . . . one responsibility.

Fully descriptive catalogs are available on both of these boilers. We'll be happy to send yours upon request.

COMBUSTION ENGINEERING

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y. B-7638

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

UNARCO Convector-Radiator
• Fitted front panel • Easy to clean • Knock-out end panels for easy installation • Cast bronze headers for added heat transmission
• 18-gauge steel front and top • Directional die-formed louvers
• Simple damper control • Carefully rounded corners for safety
• Attractive modern design
• Ideal for homes, offices, institutions, industrial and commercial uses
weather conditioning*
UNARCO
UNION ASBESTOS AND RUBBER COMPANY
HEATING AND COOLING DIVISION • 332 S. Michigan Ave. • Chicago 4, Illinois

is something
ALWAYS
missing?
(to cut your profit)

...then switch to the one line that meets every selling need

* **EXAMPLE No. 6:** It's easy to improve your profit performance with an aggressive line-up of factory experts behind you. Bryant's field representation puts the services of *all* these men at your disposal: a division sales manager; a district sales representative; and a traveling, three-man, sales-training and service team consisting of a heating product specialist; an air conditioning specialist, and a merchandising specialist. You can avail yourself of *all* these profit-building services by switching to Bryant, *now!*

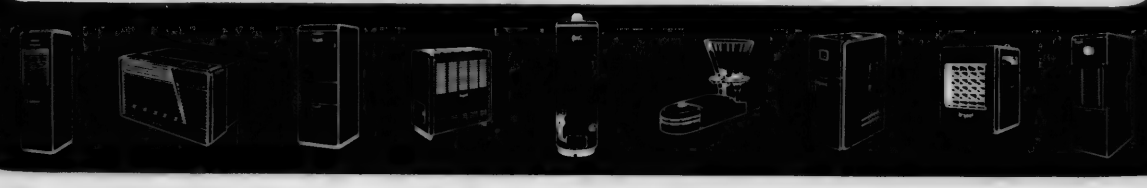
Your Bryant Distributor has full details.

bryant

HEATING | AIR CONDITIONING
WATER HEATING

1. The most complete line in the industry
2. Quality products—Competitively priced
3. Established name—Good customer acceptance
4. Broad, attractive profit margins
5. Local Distributor warehousing and service
* 6. Factory district representatives and traveling sales training and service teams

Bryant Heater Div., Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10, Ohio



Remember the trade marks "TT" and "TUBE-TURN" are applicable only to products of TUBE TURNS.

Engineered for tough service

TUBE-TURN CONCENTRIC REDUCERS provide a gentle transition from large to small diameters with strong knuckle contours. They exceed the pipe itself in bursting strength and have fatigue strength equal to that of the joining butt weld.

This extra quality at no extra cost is typical of the entire Tube Turns' line. You can specify TUBE-TURN Welding Fittings and Flanges and *know* that you will get the *exact* answer to your specific piping problem. This leading line includes more than 4000 items in all piping materials, schedules and sizes to match *your* design . . . available promptly through your nearby Tube Turns' Distributor.

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

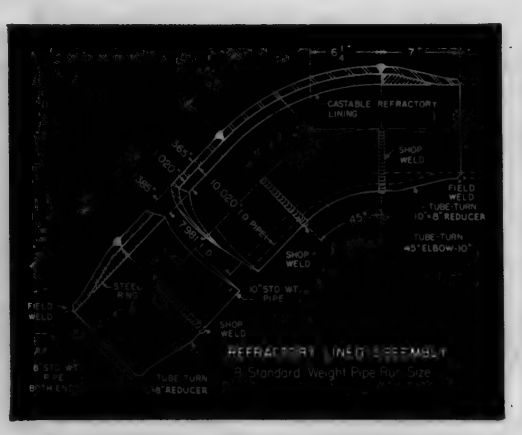
DISTRICT OFFICES. New York • Philadelphia • Pittsburgh • Cleveland • Chicago • Denver • Los Angeles
San Francisco • Seattle • Atlanta • Tulsa • Houston • Dallas • Midland, Texas

YOUR PIPING PROBLEM?
Here's service to help you...

TUBE TURNS' Engineering Service Division is staffed with men of wide experience to help solve your piping problems. Typical of many they encounter is this:

The general practice in handling highly abrasive materials in piping is to use heavy wall carbon steel elbows for directional changes, and replace these as they wear out. Recently, a new pipe lining . . . a zirconia-corundum refractory . . . was introduced with exceptional wear-resistant properties. This offers a highly satisfactory solution to the abrasion problem. The sketch shows how this lining can be applied to a 45° elbow by combining with two reducers.

This application is practical for piping of 4" through 12" diameter. Minimum thickness for casting of refractory is about one inch. It should be confined to mild pressure-temperature conditions. Additional details are available from Tube Turns' Engineering Service Division.



Design of 45° directional change with refractory-lined elbow.

YOUR SIZE: These ½-inch and 42-inch TUBE-TURN Welding Elbows are the extremes in the range of diameters available out of stock in carbon steel. Tube Turns' complete line of more than 4000 items includes fittings and flanges in carbon steels, stainless steels, chrome-moly steels, copper, aluminum, brass, monel metal, nickel and wrought iron.

YOUR SOURCE: The nearby Tube Turns' Distributor provides prompt delivery of TUBE-TURN Welding Fittings and Flanges to meet your needs exactly. He acts as your warehouse. He cuts your purchasing red-tape and time. He is backed up by the entire Tube Turns' organization.

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TUBE TURNS, Dept. B-4
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Please send free copy of booklet on Stainless Steel Piping.

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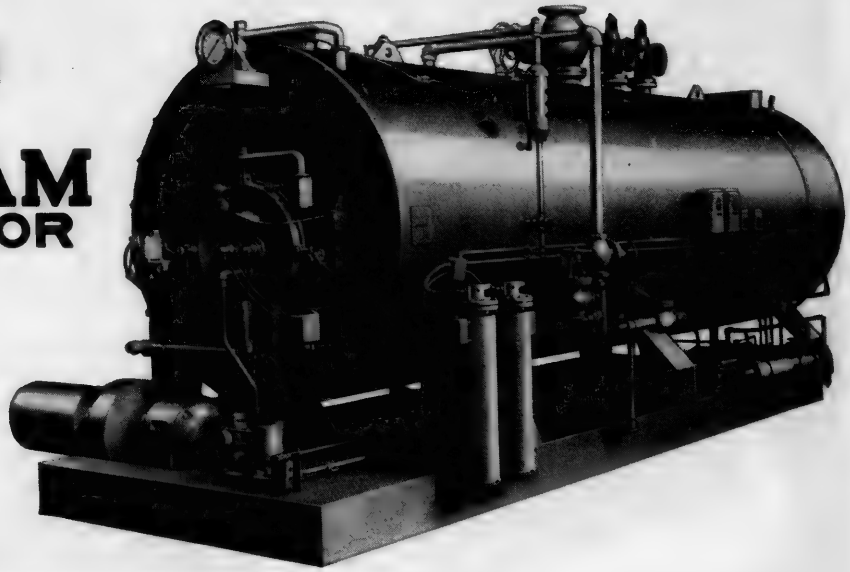
Position _____

"TT" and "TUBE-TURN" Reg. U.S. Pat.

TUBE TURNS
A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY

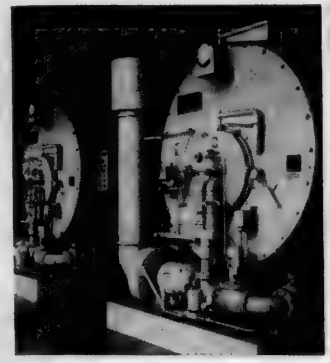
GET ALL THESE ADVANTAGES

WITH AN AMESTEAM GENERATOR



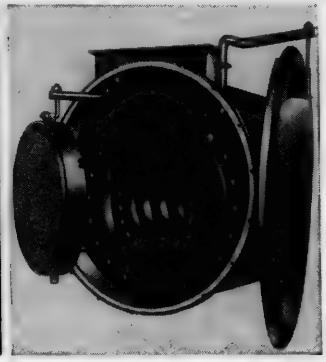
For:
PROCESSING
HEAT — POWER

20 sizes, 10 to 600 H.P., 15 to 200# W.P., oil, gas or oil-gas combinations with quick fuel switchover feature.



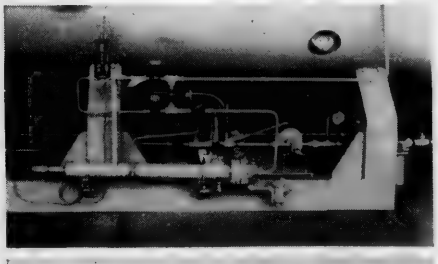
FULLY ASSEMBLED

All piping, wiring and operating parts completely assembled and tested at factory — units shipped in ready-to-fire condition!



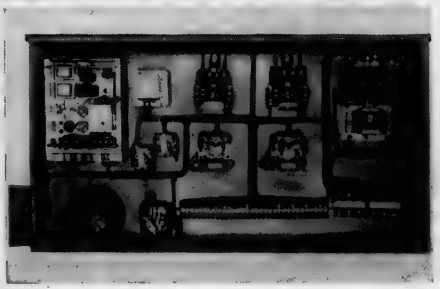
EASY TO CLEAN

Ames-designed davit hinged flue covers and baffle provide quick and complete access to the furnace and all tubes.



AMPLE ROOM

underneath for servicing auxiliary equipment. Control panel at eye level.



AUTOMATIC

operation, fully safeguarded, is provided by factory installed and tested control system.

SAVINGS IN FIRST COST!

Your purchase price includes complete unit — no hidden "extras" to buy later on!

SAVINGS AT INSTALLATIONS

Just set on level concrete floor, connect to service lines and breeching. Nothing to assemble. No brick work required.

SAVINGS IN OPERATION

A minimum of supervision — lower manhour requirements for maintenance — easily replaced inexpensive plastic refractories — 80% thermal efficiency.

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Gentlemen:

Please send me further information on AMESTEAM GENERATORS and name of nearest representative.

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ADDRESS.....

AMES IRON WORKS INC.

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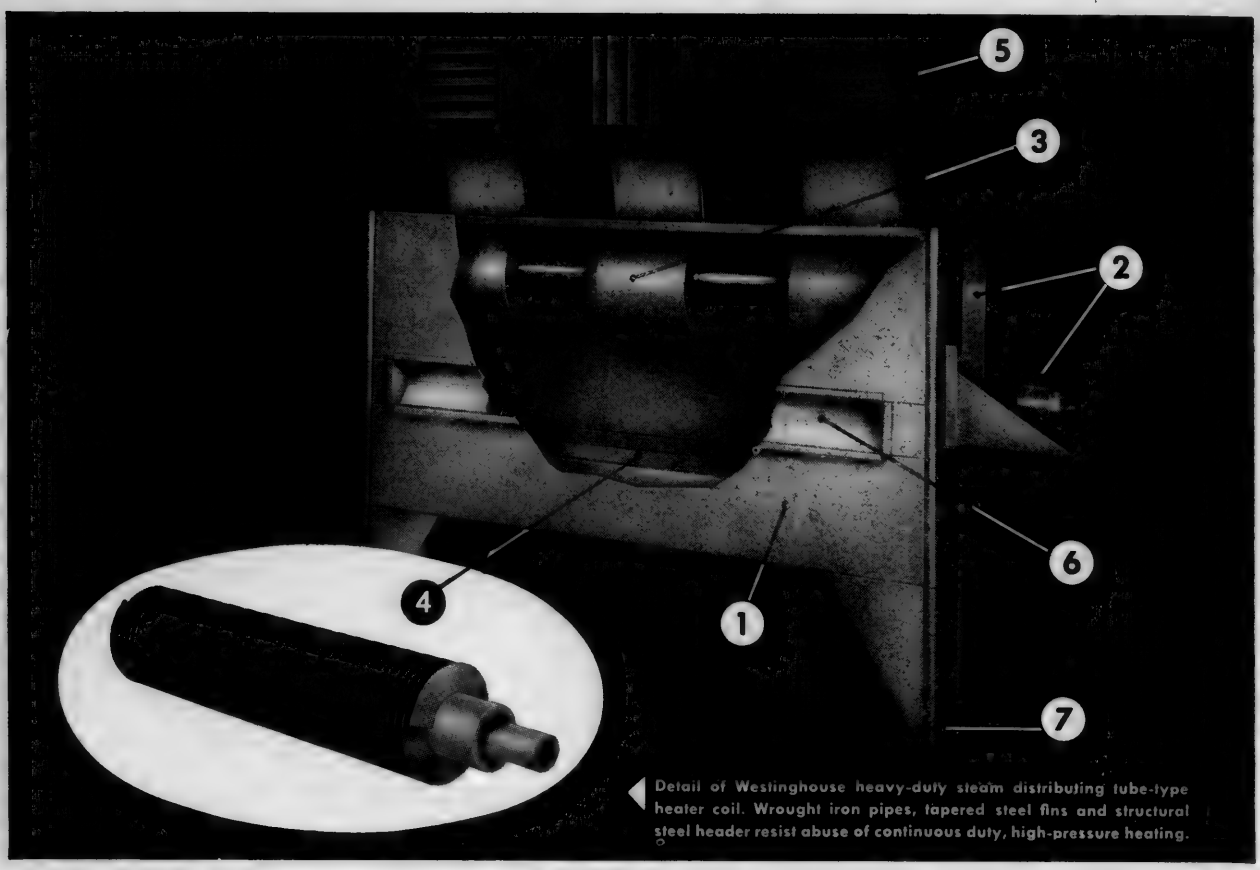


Detail of Westinghouse heavy-duty steam distributing tube-type heater coil. Wrought iron pipes, tapered steel fins and structural steel header resist abuse of continuous duty, high-pressure heating.

Rugged, Quiet Westinghouse Industrial Heaters . . . Designed For Continuous Heavy-Duty Systems!

Seven Features Assure Dependable, Versatile Coverage of Large Areas

Westinghouse Industrial Heaters supply ideal heat under difficult conditions. In plant, warehouse, garage and similar buildings, these heaters efficiently blanket large work zones, even those with high ceilings, frequently opened doors and expansive window areas. They also supply make-up air for exhaust systems . . . may be used to circulate ventilating air during warm seasons. Capacities in six sizes range up to 2,500,000 BTU/hr . . . 25,000 cfm . . . 200 psig steam pressure.

Each Westinghouse Industrial Heater is a complete unit. That's why each can be placed where it will do the most good . . . whether on floor, or wall (upright or inverted), or suspended from ceiling. Economically selected and scientifically grouped, Westinghouse Industrial Heaters satisfy the needs of areas of any size or shape, and can be readily relocated to suit plant layout changes.

Westinghouse Industrial Heaters have a line-up of features that is unique:

1. Casings are rugged heavy-gauge steel. Front and back panels are easily removed.
2. Standard motors have adjustable V-belt drive on units with motors up to 5 HP.
3. Powerful, yet quiet, fans are multiblade centrifugal type mounted on a common shaft. Blades are forwardly curved.
4. Efficient steam coils are heavy-duty or general purpose. Former are wrought iron for extra-long life (see detail shown above); latter are standard or steam distributing copper-tube type.
5. Discharge outlets and deflectors permit flexible discharge arrangements. Result: most advantageous airflow and heat distribution pattern.
6. Bypass damper arrangement permits constant air modulation. Standard arrangement permits steam modulation.
7. Rounded corners, smooth surfaces eliminate accidents, minimize dirt.

These features are backed up with a Westinghouse-Sturtevant exclusive—a single equipment warranty with undivided responsibility. This unit responsibility is your greatest guarantee of dependable performance for years to come. For complete details call on the Westinghouse-Sturtevant air handling specialist conveniently located in your area. Or write: Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S Westinghouse

J-80412

TWENTY-FOOT LENGTHS of 10" I.D. copper tubes receive final inspection in one of the mills of The American Brass Company. ANACONDA Seamless Drawn Copper Tubes are made up to 26" I.D.

Anaconda Copper Tubes last longer... can actually lower your plant piping costs

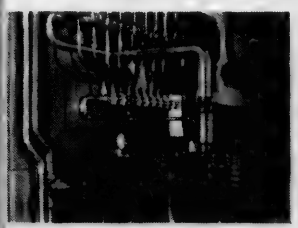
Planning a new installation? Want to replace unsatisfactory piping? Then look into the cost and performance advantages of ANACONDA Copper Tubes *first*. Many plants have found them the *least costly* piping material available.

Here's why: ANACONDA Copper Tubes are light. They come in long lengths. Smaller sizes are bent right on the job. All this means big savings on installation costs. And copper tubes can't rust. They resist corrosion and guard against contamination. Smooth interiors mean smoother flow. Pumping costs are often lower.

Here's another advantage. ANACONDA Copper Tubes – connected with solder-type fittings – can be taken down, moved or have new connections cut in faster than with threaded pipe. *You can meet changing plant conditions easily.*

If we can be of assistance in solving a piping problem in your plant please write to: *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Limited, New Toronto, Ont.*

Use Anaconda Copper Tubes for:



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HOT AND COLD WATER SUPPLY LINES

INDUSTRIAL HEATING LINES

AIR, LUBRICATING AND HYDRAULIC LINES

for copper piping call an

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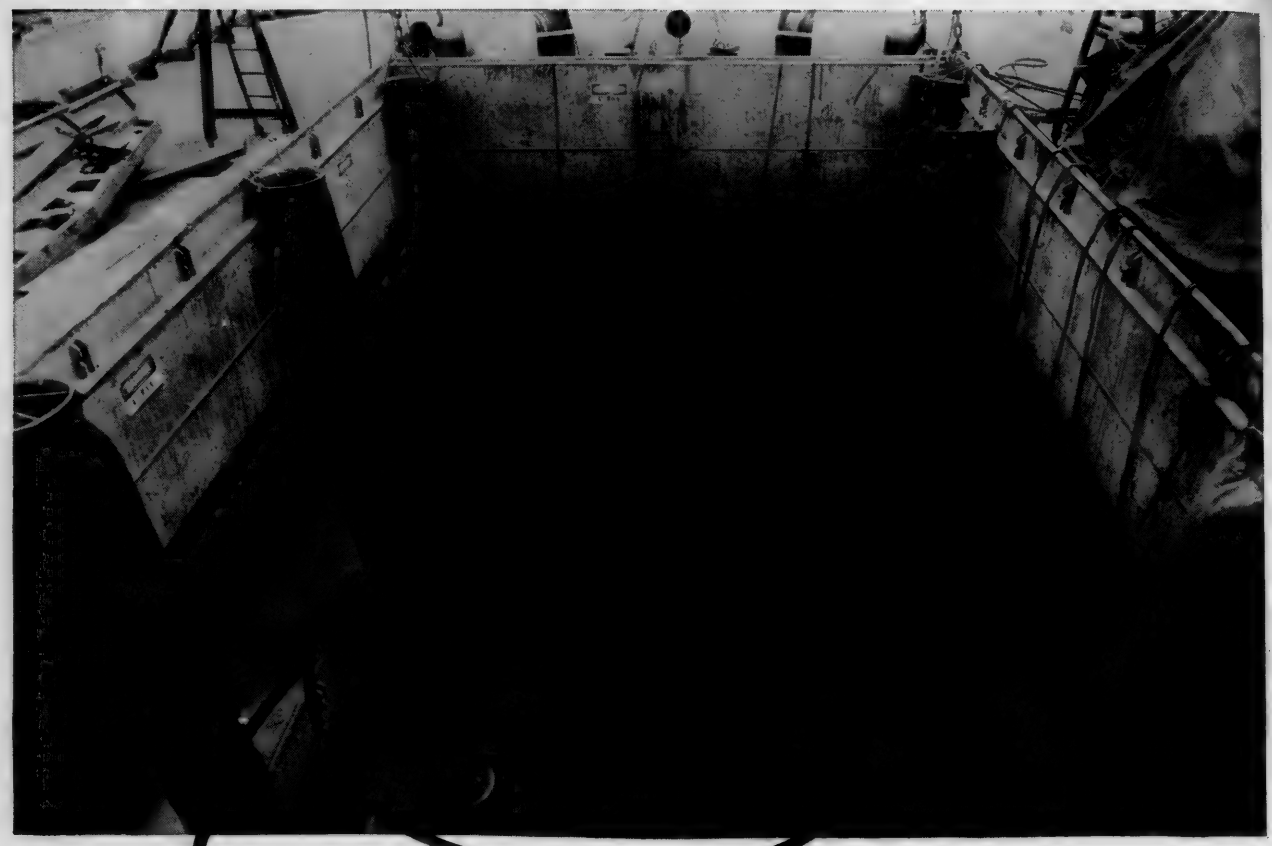
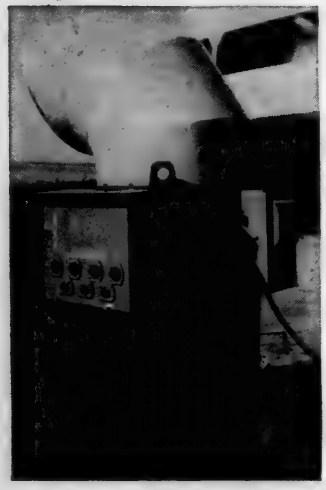


Ventilation for Spray Painting

. . . A JOB FOR JOY AXIVANE® FANS

Unexcelled performance in tight quarters, plus rugged compactness and fast, easy installation and relocation of the units when necessary . . . those were the main reasons why Joy Series 1000 Axivane Fans were selected for the vital job illustrated above. They're exhausting toxic, explosive fumes from spray-painting operations in enclosed areas below-decks in a large ship. Canvas ducts carry the fumes to open air on an upper deck.



Another shipboard job: a deck-mounted Series 1000 Fan provides air circulation in ballast tanks—5000 cfm at 3" pressure.

Applications like these effectively demonstrate the inherent advantages of Joy fans. Their vaneaxial design is highly efficient, yielding a maximum air volume-to-power ratio. Blades are of true airfoil shape, and are readily adjustable for maximum flexibility to meet varying conditions. Thick steel casings are used in the sturdy construction that smothers operating noise.

Series 1000 fans are available in 136 models, from 18" to 84" in diameter. Duties range from 600 to 200,000 cfm, and from .125" to 11" total pressure. They're easily installed right in the duct in horizontal, vertical or inclined positions with direct drive, and available also with V-belt drive. ● Let's talk over *your* fan problem—or write for Bulletin J-611. **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Consult a Joy Engineer

JOY

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WORLD'S LARGEST MANUFACTURER OF VANEAXIAL-TYPE FANS

"TUNE IN [illegible] TH[illegible]"

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Investigate this modern development in automatically controlled heating!—a high vacuum steam heating system that assures the ultimate in comfort, economy and convenience.

A **SINGLE DIAL CONTROL** "tunes in with the weather" — mild or severe — balancing heat supply against heat loss to provide an even and constant warmth that is always exactly right.

Illinois Selectotherm Systems are ideal for schools, hospitals, churches, apartments, commercial and public buildings *of any size*. They may be installed in new buildings or applied to existing buildings where boilers are used for low pressure steam heating only—with any type of fuel and any form of mechanical firing device.

Learn how Selectotherm with its reduced fuel consumption will save 20% or more compared to an ordinary heating system!

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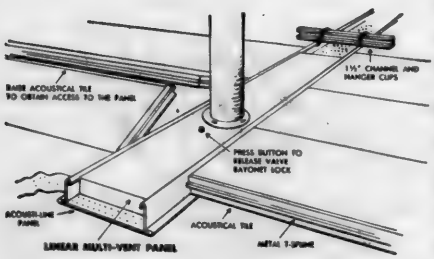
new! *Out-of-sight* AIR DIFFUSERS for acoustical block ceilings!

Now Pyle-National Multi-Vent® air diffusing panels, adapted for concealed installation in Celotex Acousti-Line ceilings, provide advantages heretofore possible only with metal pan.


BARE ACOUSTICAL TILE TO OBTAIN ACCESS TO THE PANEL
1½" CHANNEL AND HANGER CLIPS
PRESS BUTTON TO RELEASE VALVE BAYONET LOCK
ACOUSTI-LINE PANEL
ACOUSTICAL TILE
METAL T-SPLINE
LINEAR MULTI-VENT PANEL

The perforated face of Acousti-Line metal suspension panels act as diffusing plates for Multi-Vent units. No special supports are needed. Flexible connection minimizes need for accurate alignment between duct opening and Acousti-Line panels.

Note ready access to Multi-Vent unit for cleaning or valve adjustment.

NEW SMUDGE-FREE OPERATION—Multi-Vent's low velocity air delivery eliminates the dirtying or discoloration of adjacent acoustical blocks, a costly maintenance problem with high velocity diffusion.

NEW BEAUTY—Out-of-sight installation eliminates all protruding outlets and unsightly grilles. Permits complete freedom of interior design and decoration.

NEW LOWER INSTALLATION COST—Multi-Vent units can be assembled, connected to the duct, and seated in the metal suspension panels in just a few seconds. No tools are required . . . no cutting of blocks necessary.

AND, MOST IMPORTANT OF ALL—Air distribution by Multi-Vent's gentle pressure displacement assures perfectly even air motion and exceptional uniformity and control of room temperatures. The total absence of strong air streams or blow eliminates all usual sources of draft complaints and permits complete freedom in relocating partitions.

For complete information about Multi-Vent installations for all types of ceilings consult the Pyle-National Sales Engineer in your vicinity, or write direct.

MULTI-VENT DIVISION
Sales and Engineering Representatives in Principal Cities of United States and Canada

THE PYLE-NATIONAL COMPANY
1374 North Kostner Avenue Chicago 51, Illinois

TURBO-GENERATORS • FLOODLIGHTS • PLUGS AND RECEPTACLES • CONDUIT FITTINGS

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Reading Tube Corporation Plant at Reading, Pa.

THE Reading reputation for quality and service is second to none in the industry. This is the plant behind that reputation—a plant dedicated to supplying your copper tube needs with a product of dependable, uniform quality that you can sell or install with complete confidence.

Here, in one of America's largest, completely integrated mills, specializing in the processing of copper tube from basic metal to finished tubing, Reading Copper tube is produced with the newest, most modern equipment known to metallurgical science.

Reading's unique 4-way inspection checks and certifies accurate adherence to the most exacting standards.

Reading's superior service and quality place you in a better position to supply your customers' needs —help you build your business. Next time you order copper tube, specify Reading—for quality and service you can depend on!

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TUBE CORPORATION
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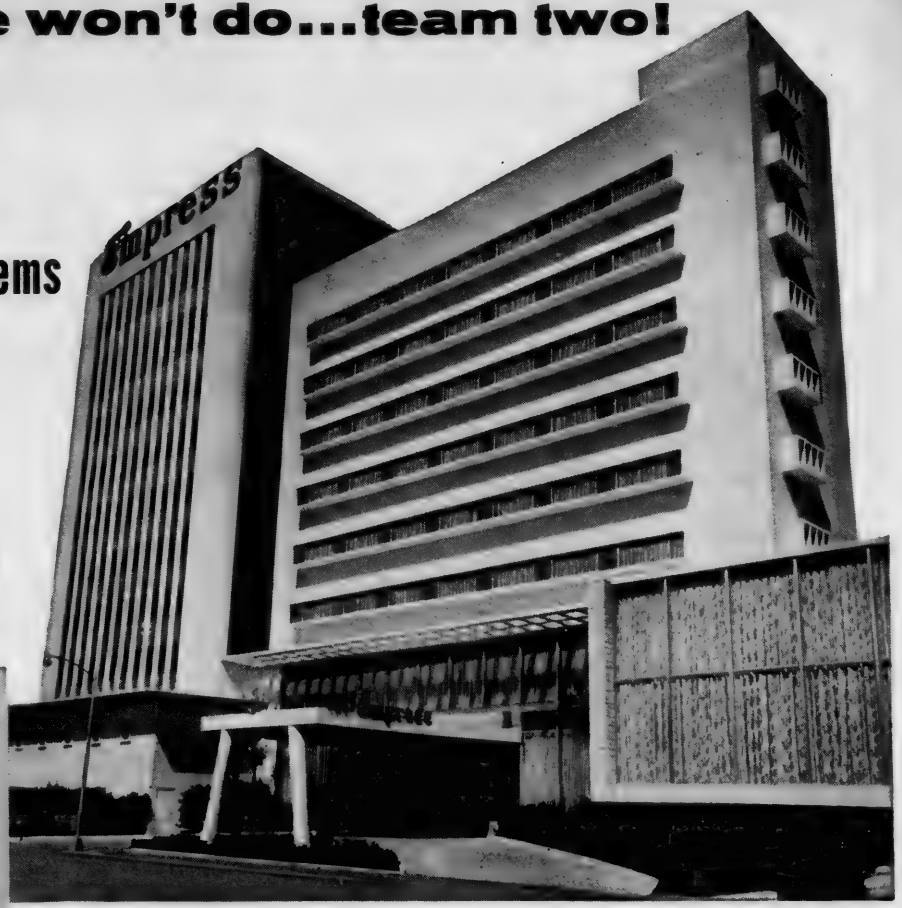
where one won't do...team two!

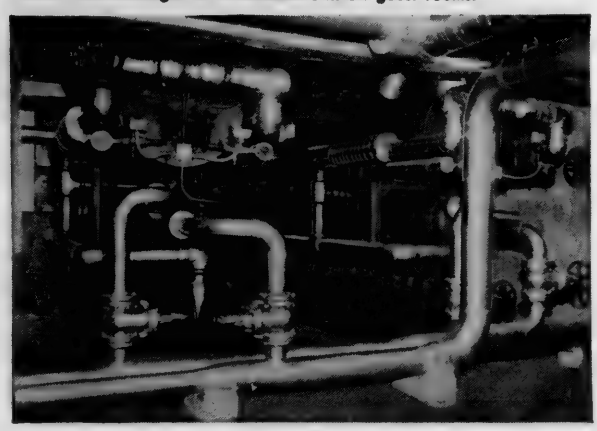
Chrysler Airtemp Air Conditioning Combines 2 Systems

for best results in this new Miami Beach Hotel



Chrysler Airtemp System of year 'round air conditioning serving rooms allows guests to select their own indoor climate at all times. When a room is not occupied, its air conditioning unit is turned off completely for economy.

Three 100-H.P. Chrysler Airtemp "Packaged" Chillers dispatch chilled water to out-of-sight air conditioners in all guest rooms.

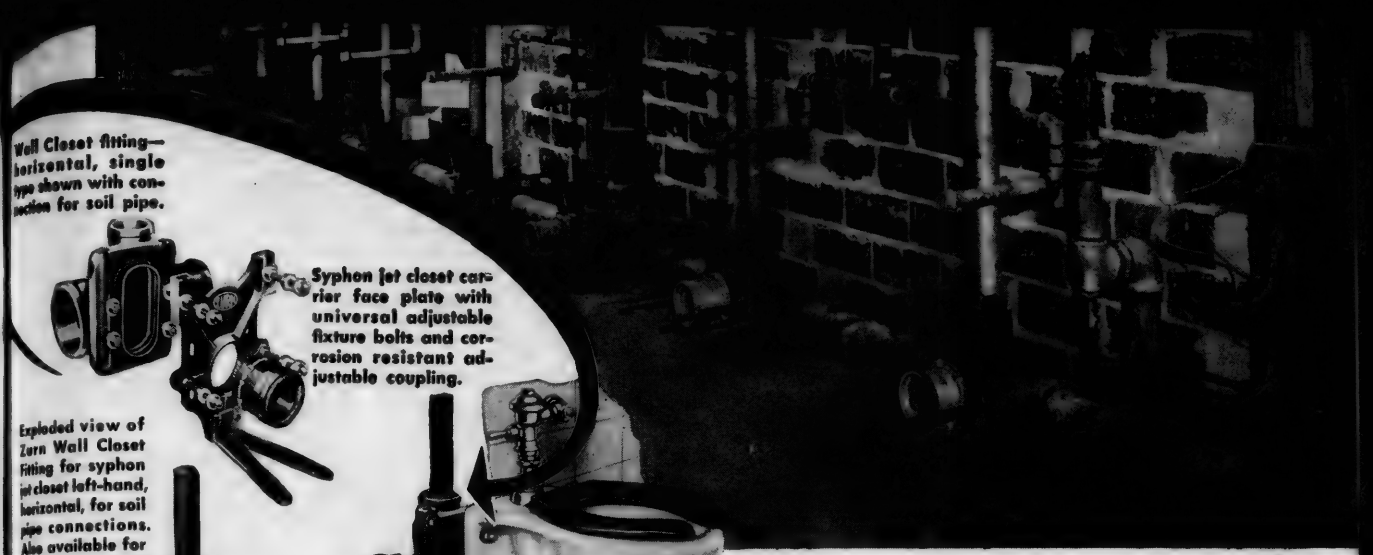


In lobby, cocktail lounge, restaurant and other public rooms, a hotel must provide a comfortable atmosphere all year around. So a Chrysler Airtemp Central Duct System, with centralized control, was selected to supply conditioned air for these areas of the new Empress Hotel in Miami Beach. But to give guests complete control of the temperature in their own rooms, a system of individual air conditioning units was also employed. These concealed overhead units utilize chilled water in summer and warm water in winter.

Precision-built equipment for all types of air conditioning —one system or any specially-engineered combination of systems — is manufactured by Chrysler Airtemp in a modern, air conditioned plant. And to expedite the work of architects, engineers and contractors, Chrysler Airtemp offers a complete air conditioning service through Airtemp Construction Corporation, a wholly-owned subsidiary. Just write Airtemp Division, Chrysler Corporation, Dept. HV, 1600 Webster Street, Dayton 1, Ohio.

CHRYSLER AIRTEMP

HEATING • AIR CONDITIONING for HOMES, BUSINESS, INDUSTRY
AIRTEMP DIVISION, CHRYSLER CORPORATION
Dayton 1, Ohio



Wall Closet fitting—horizontal, single type shown with connection for soil pipe.

Syphon jet closet carrier face plate with universal adjustable fixture bolts and corrosion resistant adjustable coupling.

Exploded view of Zurn Wall Closet Fitting for syphon jet closet left-hand, horizontal, for soil pipe connections. Also available for threaded pipe connection.

Pat. and Pat. Pend.

Zurn Horizontal Adjustable Wall Closet Fittings roughed-in in a large Chemical Plant

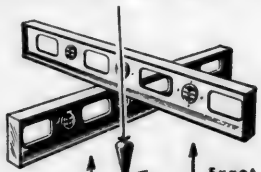
ZURN systems*

Simplify *Wall-Type Fixture Installations* and Usually Reduce Time-Costs

THE ZURN WAY

PERFECT ALIGNMENT IN ALL 3 DIRECTIONS

Obtained with Exclusive Adjustment Features of Zurn Wall Closet Fittings And Carriers...For The Support of All Types And Makes of Wall Type Fixtures



Permanent horizontal alignment of each fixture with all others.

Vertical adjustment of fixture to any required height from the floor.

Exact adjustment of fixture at 90° to the wall.

Copyright 1954

● A Zurn System includes everything except the pipe for installing wall-type toilets up to where the horizontal drainage line connects with the stack. Installations are above the floor, behind the toilets, behind the wall. There are no delays waiting for other crafts.

A Zurn System offers these plus features and advantages: *flexibility* which assures speed in assembly and accurate alignment in all three directions during installation; *rigid water-tight connections* insure minimum final adjustments; *bulk of assembly can be precut in shop; unique waterway allowing a 4" vertical adjustment* does away with numbered fittings.

Zurn Systems are available for installing any type or make of wall-type toilet, urinal, lavatory, sink or other wall-type fixtures. Write for free booklet, "You Can Build It and Maintain It for Less, A NEW WAY".

* T.M. Reg. U.S. Pat. Off.

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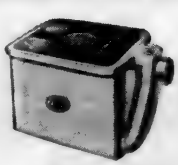
***Affiliate:* American Flexible Coupling Co., Amerigear Couplings with Fully Crowned Teeth**

ZURN PLUMBING DIVISION PRODUCTS INCLUDE EVERYTHING FOR DRAINAGE SYSTEMS FROM ROOF TO BASEMENT.

One of several types of Zurn Engineered Carriers for wall-type urinals.



Greaseptor.

Area Floor Drain.

Backwater Valve Non-fouling.

Roof Drain with Internal Expansion Joint; High Velocity Drainage.

Supremo Perfect Seal Floor Level Cleanout.

Over 700,000 Wall-Type Fixtures Now Installed with ZURN SYSTEMS in Buildings of Every Type From Coast to Coast. Write for list of buildings having rest rooms with fixture-bare floors.

J. A. ZURN MFG. CO., *Plumbing Division*
Erie, Pa., U. S. A.

Please send me the new Zurn booklet, "You Can Build It and Maintain It For Less A NEW WAY".

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Company .....

Street .....

City and State .....

Please attach coupon to your business letterhead
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The Ric-wil Company represents over 40 years of manufacturing Quality Insulated piping systems. The complete Ric-wil product line is continuously pre-proven by laboratory and field tests to maintain this superior quality.

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THE RIC-WIL COMPANY
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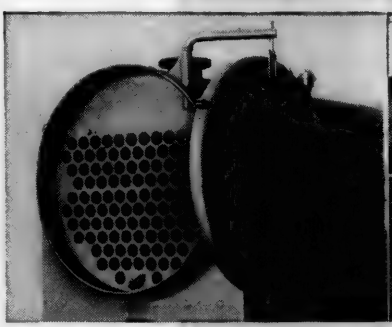
"COMPACT" IS THE WORD FOR THIS SPACE-SAVING TITUSVILLE BOILER

ALL SIZES FROM 129 TO 2500
SQ. FT. OF HEATING SURFACE

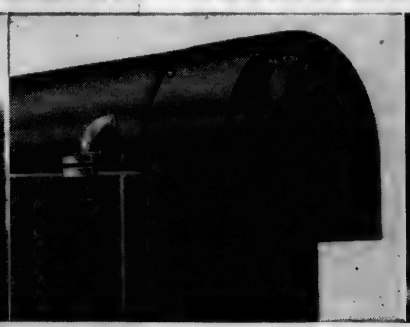
S.B.I. rated for known, dependable performance

Modern, space-saving design makes the "Compact" Steel Heating Boiler particularly adaptable to cramped boiler-room areas . . . sturdy welded construction, large combustion chambers, long fire travel and positive circulation combine for high efficiencies and years of low-maintenance service! Get the facts—write for "Compact" Bulletin B-3000-B today.

TYPICAL "COMPACT" ENGINEERING FEATURES



Full width flue doors give quick access to all tubes for cleaning.



Smoke box at rear of boiler provides a natural soot hopper, easily cleaned.

Ample number of side circulators insure positive circulation, increased efficiency.

TITUSVILLE IRON WORKS CO TITUSVILLE, PA.

A DIVISION OF Struthers Wells

THE TITUSVILLE IRON WORKS COMPANY
TITUSVILLE, PENNA.

Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement

RADIANT HEATING

the ultimate in efficiency where budgets control the building plans

● The First Methodist Church of Plainfield, Iowa, had to be more than just a church to warrant the expense of its construction. Consequently, architects Schweikher & Elting, although limited by a budget of $67,000, designed this remarkably flexible building for the 1300 church members. It includes:

- **A church assembly room for 140 worshippers.**
- **A social hall with stage that will seat up to 90 people.**
- **A 350-sq. ft. kitchen to serve the social hall.**
- **Four distinct classrooms with sliding walls. Will seat 70 persons.**
- **All the storage, office and service space required of a small community building.**
- **A complete radiant heating system of USS NATIONAL Steel Pipe.**

In such installations where efficiency is the key word, there is no better choice of materials to be made than NATIONAL Pipe—dependability at a moderate price. So dependable that architects and contractors have been specifying it for over 60 years as the "standard" for conventional plumbing and heating systems. They know that NATIONAL Steel Pipe has the inherent characteristics necessary to meet the requirements of such applications—smooth, uniform bending; sound, strong welding properties; and long service life—characteristics that have made it the largest selling pipe in the world.

For further information on the application of USS NATIONAL Steel Pipe to radiant heating and snow melting services, write:

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USS NATIONAL Steel PIPE

UNITED STATES STEEL

The Quality Pump is the SKIDMORE Pump

If you're interested in reducing installation and maintenance costs — don't overlook Skidmore's wide range of exceptionally dependable pumps.

Designed specifically for every installation requirement . . . Skidmore Pumps are built compactly and are easily installed, whether for below floor level returns or in cramped quarters. Experience of over a quarter of a century insures peak performance and longer service life.

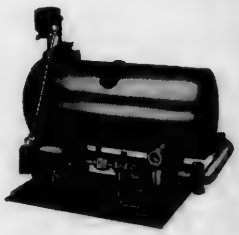
SKIDMORE VACUUM PUMP

Automatically adjust to the varying conditions of the system. Capacities — ranging from 5,000 to 100,000 sq. ft. EDR. Available in both single and duplex units.

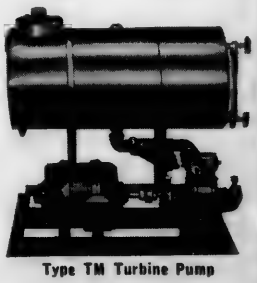
SKIDMORE PUMPS

SKIDMORE CORPORATION
St. Joseph, Michigan

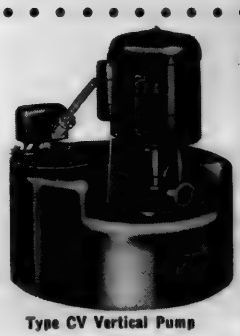
Type UV Condensate Pump



Type HS Condensate Pump



Type TM Turbine Pump



Type CV Vertical Pump

. . . FOR A SPECIFIC PUMP REQUIREMENT

If you are faced with the responsibility of a choice, Skidmore offers many types and units for you to select the correct design to meet your individual requirements.

Type UV Condensation Pump is designed for below floor level returns and is built in single and duplex units.

Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.

Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.

Type CV Vertical Pump — ideal where space is limited. Each model like every Skidmore Pump is built to meet specific requirements. For the correct solution to your own pump problem consult a Skidmore Heating Pump Specialist.

with Marlo

AIR CONDITIONING

every room is a QUIET ZONE

Marlo SEAZONAIRE Units

Operate at Absolute Minimum Noise Level

for Peaceful, Undisturbed Comfort

Designed and built *with silence in mind,* Marlo Remote Room Units are the most practical answer to the problem of air conditioning hotels, motels, offices and other areas in which quiet operation is essential. This important feature is achieved through careful attention to the smallest detail of engineering and construction, with special emphasis on

- **low operating speeds**
- **low fan tip speed and low fan outlet velocities**
- **interior coating of sound-absorbent mastic**
- **heavy-gauge, vibration-resistant steel cabinets**
- **extra large motor bearings and shaft diameters to reduce vibration**

Marlo units are easy to install, easy to maintain, provide individual selection of desired temperature in summer and winter.

Write today for details on the complete line of Marlo quality air conditioning equipment.

Marlo COIL COMPANY

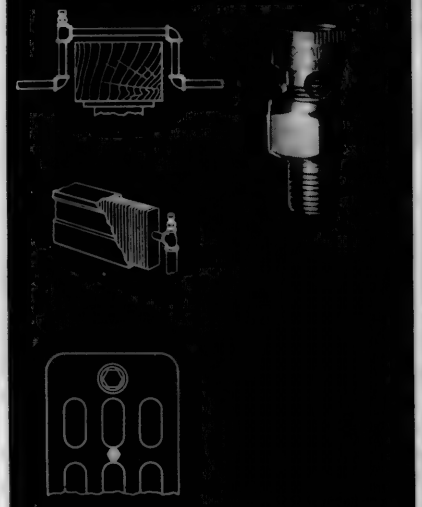
Manufacturers of COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS • AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

Saint Louis 10, Missouri

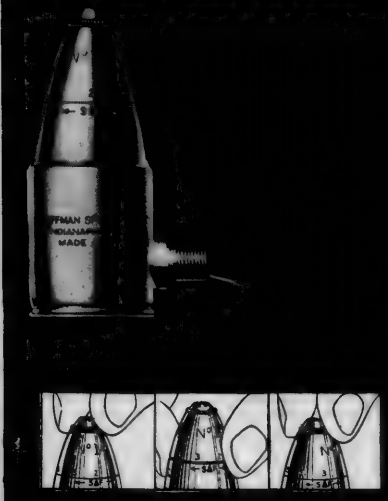
HOFFMAN VENTING VALVES

FOR EVERY STEAM and HOT WATER SYSTEM

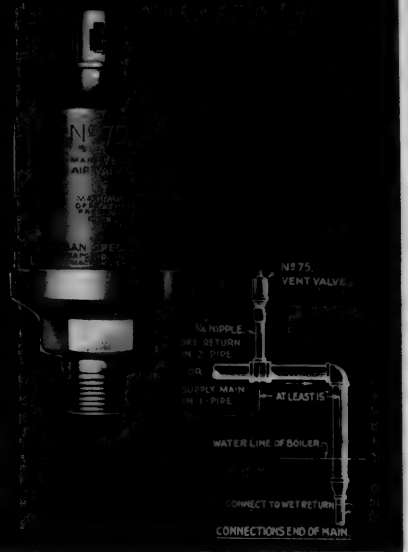
No. 500
UNIVERSAL AIR VENT



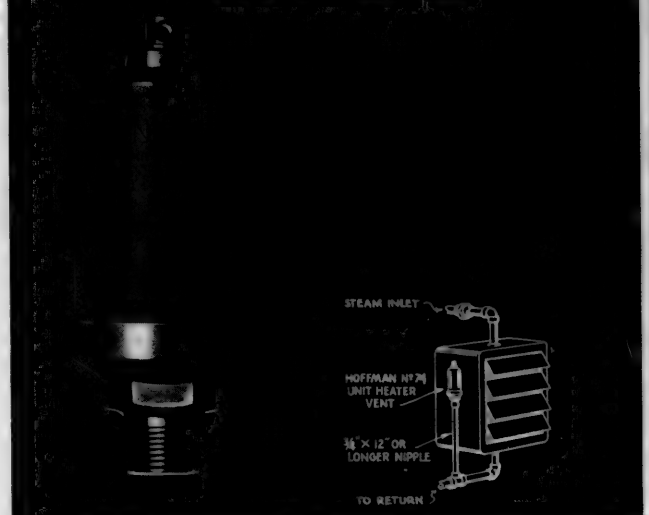
No. 1A BALANCER
WITH CHOICE OF 6 VENT PORTS TO FIT EVERY VENTING REQUIREMENT



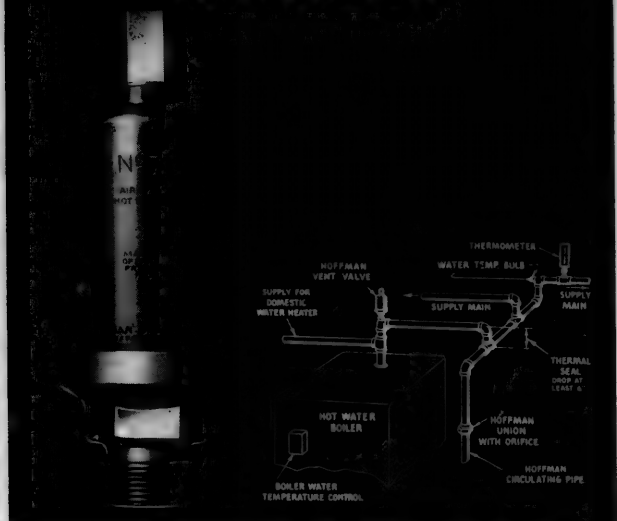
No. 75
MAIN VENT



No. 74
FOR UNIT HEATERS



No. 79
HOT WATER VENT

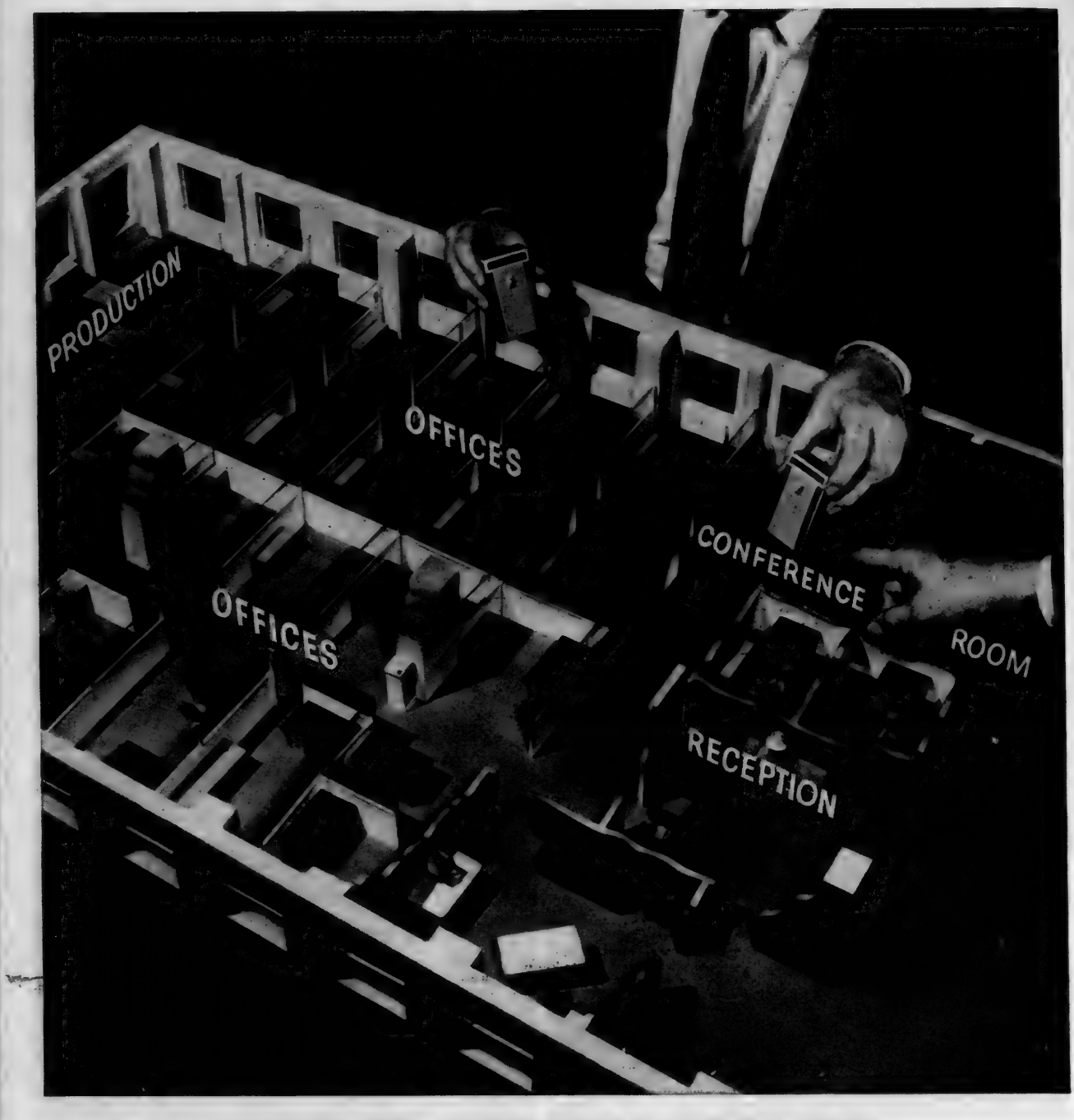


Have these valves in your stock for the early replacement jobs

For either one-pipe or two-pipe steam, hot water, residential or industrial heating—Hoffman assures you the correct Vent Valve for each specific requirement. For the hard-to-balance radiators, the Hoffman line includes adjustable-port valves, available for vacuum and non-vacuum systems. It is not too early to order adequate stocks of Main and Radiator Vent Valves for modernizing jobs. Call your Wholesaler.

HOFFMAN SPECIALTY MFG. CORP. • 1001 York Street, Indianapolis 7, Indiana

Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensation Pumps — Sold by Leading Wholesalers of Heating and Plumbing Equipment



HOW TO SPECIFY COOLING —even on jobs with limited budgets

It's easy—with G.E.'s compact new Packaged Air Conditioners. Here's why! G.E.'s STEP-BY-STEP plan enables your client or customer to cool key areas first. Later, when budget permits, he adds extra G-E packaged units, to cool other areas.

G-E units are priced surprisingly low. Installation costs are low, too. In many applications, no ducts or machinery rooms are required. Space is no problem because there's a G-E unit to fit any situation; so compact it can even be squeezed into corridors and little-used areas.

Unprecedented 5-YEAR WARRANTY covers *entire* refrigeration system. Trouble-free, sealed-in cooling unit eliminates need for expensive maintenance crews.

To find out how you can specify G-E Packaged Air Conditioners profitably, write General Electric Co., Sec. HV-8, Air Conditioning Div., Bloomfield, N. J.

GENERAL ELECTRIC

Packaged AIR CONDITIONERS

FOR BUSINESS AND INDUSTRY

The most convincing stamp of user satisfaction

ANOTHER REPEAT ORDER FOR SARCO

now another Ford Plant

equipped with Sarco heating specialties

Ford Foundry, Cleveland. *Architects and Engineers:* F. A. Fairbrother and George H. Miehls. *Consultants.* Albert Kahn Associated Architects and Engineers, Inc., Detroit. *Heating Contractors:* Smith and Oby Co., Cleveland.

8 Ford Plants now rely on Sarco dependability

To get repeat business it takes more than just promises of product performance . . . *it takes proof.*

For the past fifteen years Sarco product performance has been proved seven times over to the Ford Motor Company. Now the new Cleveland Foundry is the eighth Ford plant to be equipped with Sarco Heating Specialties. Over 7,000 steam traps, strainers, radiator valves and traps and other Sarco Specialties give dependable, efficient service in all eight plants.

Doesn't this repeat business speak for itself?

Specify Sarco Heating Specialties on your next job and be assured of complete customer satisfaction. Full details of all Sarco products are available on request.

Other SARCO-EQUIPPED plants of the Ford Motor Company

DEARBORN, MICHIGAN, *Ford Styling Building*
CLEVELAND, OHIO, *Engine Plant*
WAYNE, MICH., *Lincoln-Mercury Assembly Plant*
BUFFALO, N. Y., *Ford Stamping Plant*
DALLAS, TEXAS, *Ford Assembly Plant*
KANSAS CITY, MISSOURI, *Ford Aircraft Plant*
METUCHEN, NEW JERSEY, *Lincoln-Mercury Assembly Plant.*

Here's why so many architects, engineers and heating contractors specify and install Sarco

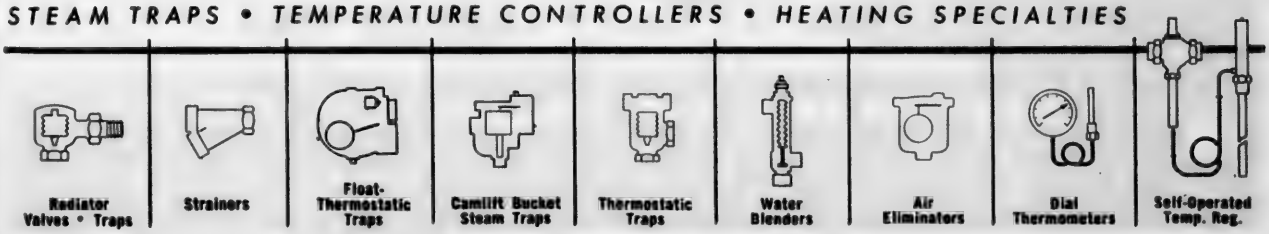
— job after job.

- **Proven dependability**
- **Trouble-free service**
- **Complete line from one reliable manufacturer**
- **Nationally known and preferred**

SARCO SAVES STEAM

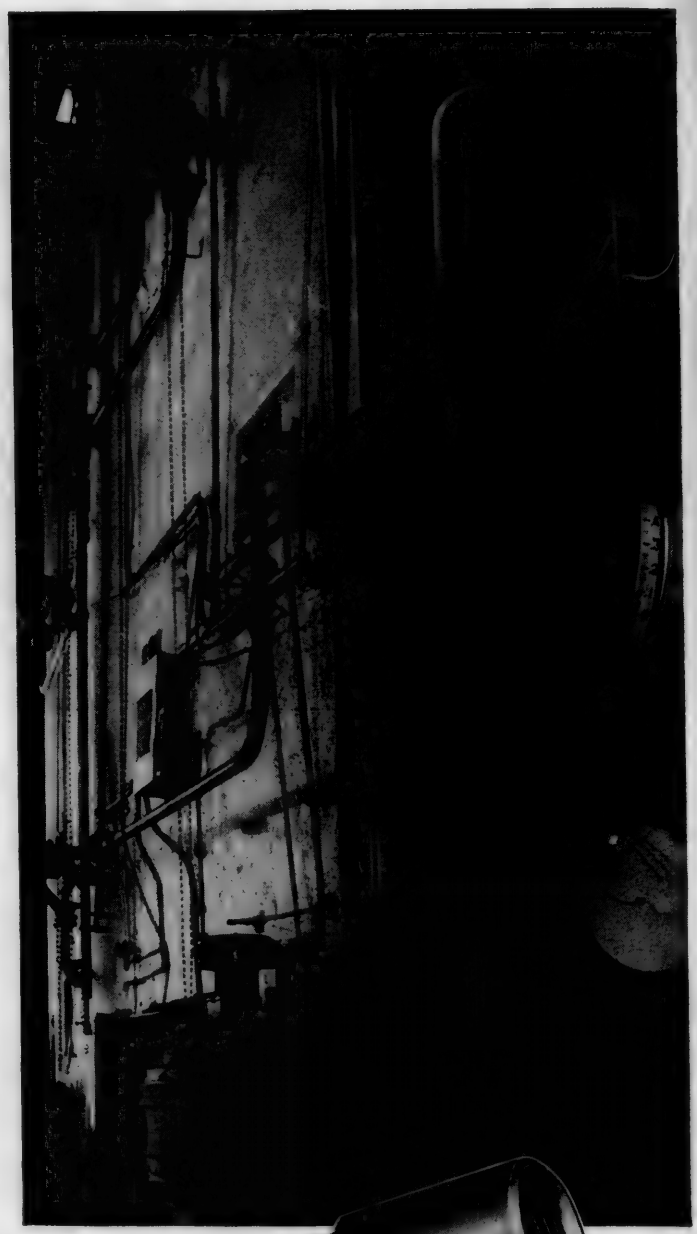
SARCO COMPANY, INC., Empire State Building, New York 1, N. Y.

STEAM TRAPS • TEMPERATURE CONTROLLERS • HEATING SPECIALTIES



Radiator Valves • Traps | Strainers | Float-Thermostatic Traps | Camlift Bucket Steam Traps | Thermostatic Traps | Water Blenders | Air Eliminators | Dial Thermometers | Self-Operated Temp. Reg.

This YOLOY pipe has lasted 6 times longer



The pipe shown in the photograph of this large boiler carries steam for the "soot" and "fly ash" blower system in an Ohio electric plant. The service is so severe that regular carbon steel pipe had to be replaced as often as 60 days.

A solution for this corrosion problem was obtained by installing Yoloy pipe. Now, twelve months later, the Yoloy pipe is still in service—hasn't developed a single leak. It has lasted six times longer, and looks good for many months more.

Yoloy Continuous Weld Pipe is made from the same nickel-copper steel composition that has proved so successful in the oil, mining, railroad, chemical, trucking and other industries where resistance to corrosion and abrasion is of prime importance. It is now available in pipe sizes, from ½" to 4".

Get our booklet "The ABC of Yoloy Continuous Weld Pipe and its Corrosion Resistance". Write or phone the Youngstown District Sales Office near you.

Youngstown

YOLOY PIPE

QUALITY V YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY Manufacturers of Carbon, Alloy and Yoloy Steel

General Offices: Youngstown, Ohio - District Sales Offices in Principal Cities

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - BAR SHAPES - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - RAILROAD TRACK SPIKES

HEAT-VENTILATE YOUR PLANT

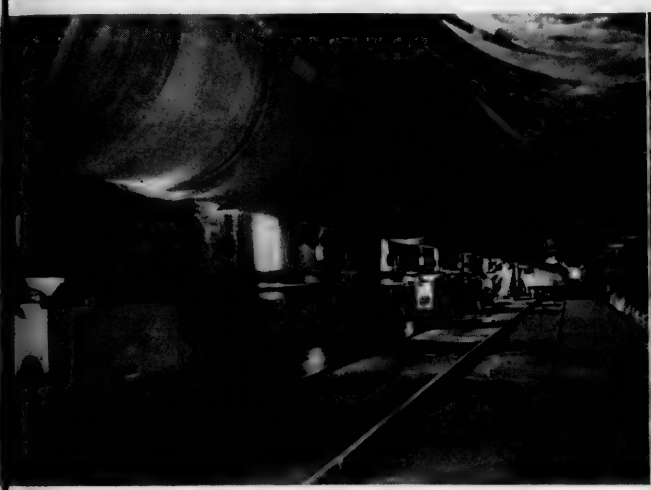
WITH THESE SPACE-SAVER "BUFFALO" UNITS!

NO FLOOR SPACE REQUIRED

a "Buffalo" Suspended Lowboy Unit Heater. Easily mounted of trusses. Spreads abundant, low-cost heat where you need rovides ventilation in warm weather.

FRESH, CLEAN WARM AIR

(or cool outside air) is delivered by a compact "Buffalo" Highboy Unit with fresh air filtered intake thru side wall. Bearing bowl at left permits easy external lubrication.



LOW OVERHEAD — HIGH EFFICIENCY!

-mounted Lowboys provide plenty of heat even where quarters cramped. New coil design increases heating surface, with ower coil section. Coils are non-freeze.

SWIVEL OUTLETS "AIM" FLOW

accurately — a "Buffalo" efficiency feature. Others are "Buffalo" mixed-flow fans with unusually stable performance — standardized parts — lifetime construction.

Let us show you NOW how low-cost and easy it is

to heat and ventilate your plant. Bulletin 3704-A gives all details on the units to handle your heating — ventilating — makeup air problem. Handy chart gives you air diffusion distances for each unit and capacity up to 35,000 cfm.

WRITE FOR BULLETIN 3704-A TODAY!

"Buffalo"

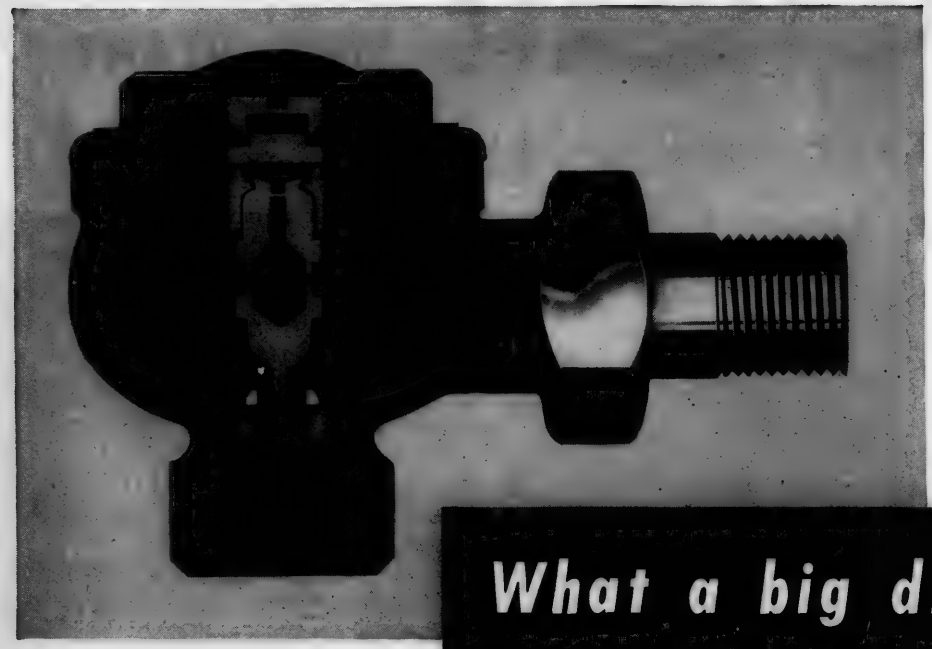
BUFFALO FORGE COMPANY

480 BROADWAY BUFFALO, NEW YORK

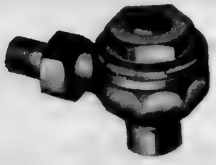
PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

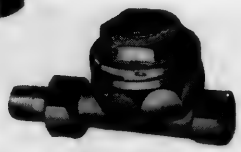
SURE BLOWING COOLING HEATING FORCED DRAFT VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING



What a big difference a trap can make!



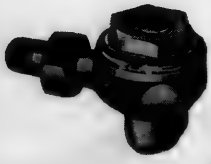
Angle



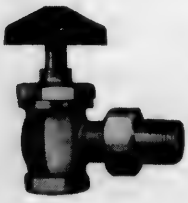
Straightway

Vertical

Left hand corner



Right hand corner



Marsh Packless Radiator Valves are perfect team mates for Marsh Radiator Traps. The metal-to-metal seal places them in a class all their own.

Yes, the success or failure of a steam distribution system can hinge on things as small as radiator traps. That's why it pays to use Marsh Radiator Traps—traps that are individually and permanently adjusted to close tight on steam, but open promptly and pass air or condensate at temperatures only a few degrees below closing temperature.

The part that provides positive operation in Marsh Radiator Traps is that rugged-but-sensitive thermostatic diaphragm. After this element has been assembled it is made completely seamless by a heavy overall deposit of copper. It is then filled with an accurately measured charge of volatile fluid; finally tested by expert operators to make sure that its expansion and contraction is exactly right to produce the utmost efficiency and economy.

Construction throughout is in keeping with the effective diaphragm. Bodies are of extra heavy cast brass suitable for pressures up to 125 lbs. steam. Bonnet assemblies of a given type and size are interchangeable. Trap seats are renewable. All components are made with a large safety factor beyond rated operating pressures.

Next time make it Marsh throughout and see the difference . . . Marsh traps, packless valves, bucket traps, venting valves. All are covered in the new fact-filled catalog.

MARSH HEATING EQUIPMENT CO.

Sales affiliate of Jas. P. Marsh Corporation

Dept. U, Skokie, Illinois

MARSH

Heating Specialties **SINCE 1865**

York brings new standards of comfort to modern air conditioning—and architects, building owners and managers are showing their approval by specifying York equipment for more and more buildings, old and new.

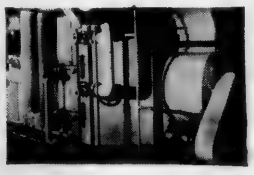
The Equitable Life Assurance Society Building is an example. This impressive structure will tower 25 stories skyward . . . the *first* large office building in San Francisco to have complete air conditioning.

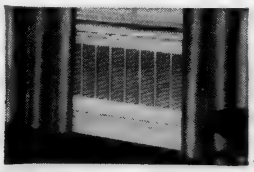
Naturally, the tremendous glass areas of this building presented a sizeable heat-load problem. York engineers—who have a wide range of systems from which to choose, who even design special systems to provide the *right kind* of air conditioning for unusual structures—are furnishing a Yorkaire Low-Pressure Induction Unit System as the perfect answer.

In homes and offices, ships and stores, skyscrapers, factories, hospitals, theaters . . . almost everywhere you go, when the air conditioning is just right, chances are it's York Air Conditioning . . .

. . . so a Yorkaire System of air conditioning was chosen, also, for San Francisco's newest skyscraper!

Beautiful new Equitable Life Assurance Society Building
Architects—Loubet and Glynn, Associates of the late W. D. Peugh of San Francisco
Consulting Architect—Irwin Clavan
General Contractors—Dinwiddie Construction Co. of San Francisco
Mechanical Contractors—Scott-Nelson of San Francisco





● Source of comfort cooling in the Equitable Life Assurance Society Building is a 600-hp York Turbo Water Cooling System. ● "Raw" air from outdoors is filtered, washed, cooled or heated, and moisture conditioned. When it's "just right for comfort," it's sent under mild pressure to you. Coils, on every fourth floor, maintain the coolness of the conditioned air. ● Room units (1177 in the Equitable Life Assurance Society Building) release the conditioned air in a gentle, quiet stream at the exact comfort needs of each office.

IF YOU ARE ABOUT TO AIR CONDITION—

Remember, York engineers brought the right kind of comfort cooling to such important projects as the Empire State Building, the S. S. United States, Cincinnati's Netherland-Plaza Hotel, Atlanta's Fulton National Bank, the Esso Standard Oil Company in Philadelphia and the Mile High Center in Denver. You can take advantage of York's wide range of equipment and experience by calling any York District Office (located in principal cities), or writing: York Corporation, York, Penna.

air conditioning by york

YORK CORP. York YORK, PA.

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

HEATING PUMPS

To always meet

ALL REQUIREMENTS

CHICAGO INDUSTRIAL PUMPS

Chicago's complete line of heating pumps are designed to meet the specific and exacting needs of building service. When you specify Chicago Heating Pumps you can be certain you will always get the correct pump for the job.

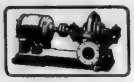
You can get the complete data on any or all series of Chicago Heating Pumps simply by writing for the technical Bulletin referred to under each type. This information is truly complete—includes engineering, specification and dimension data, as well as performance records, charts and tables.

CHICAGO PUMP COMPANY

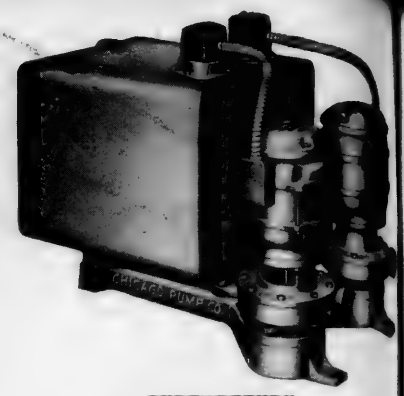
BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY — **CHICAGO 14, ILLINOIS**

Condo-Vac, Sure Return. AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems.



Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.

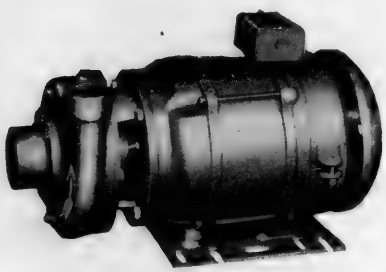


SURE RETURN CONDENSATION PUMP & RECEIVER

For systems up to 75,000 EDR and f low and medium pressures. Available either single or duplex units. The b serves as a large capacity manifo through which the condensate flows gravity from the receiver to the pum The Sure Return will not steam bin Described in Bulletin 250.

TYPE CLLI VERTICAL CONDENSATION PUMP & RECEIVER

Specifically designed for low return service and underground installations. Flanges are accurately finished and gasketed to prevent steam leaks. Pump and receiver are shipped as a unit, ready to install. For 1000 to 40,000 EDR and 10 to 25 lbs. pressure. Described in Bulletin 255.

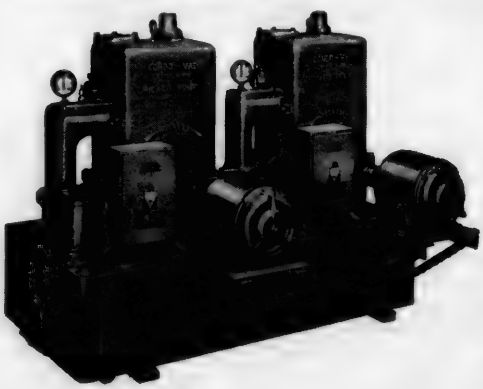


C-C CLOSE-COUPLED SERIES PUMPS

C-C Series Pumps combine pump and motor in a single compact unit for easy installation, eliminating coupling and alignment problems, and are equipped with the leak-proof CHICAGO mechanical seal. Each pump operates over the entire range of its curve without motor over-load.

DUPLEX CONDO-VAC RETURN LINE VACUUM AND BOILER FEED PUMP

Specifically designed for vacuum heating systems. The water capacity of the Condo-Vac remains constant up to the boiling point. The air capacity remains constant to the evaporation point. Pressures up to 40 lbs. Capacities from 2500 to 150,000 EDR. Described in Bulletin 270.



TYPE AVC CONDENSATION PUMP & RECEIVER

Heavy cast iron receiver with low in for floor mounting or shallow pit. S on floor—no foundation bolts necessa Weight of unit and piping hold u firmly in place. For 500 to 10,000 E and 10 to 30 lbs. pressure. See Bul tin 245.

GIVE EVERY JOB *The Quality Touch* OF CHASE COPPER

Copper adds extra value to any home!

Use Chase Copper Tube in your next radiant heating installation, and you'll do a *quality* job better...and *faster*.

Because Chase Copper Tube comes in compact coils, it's easier to handle, saves you time. And since Chase Copper Tube comes in *long length* coils, you reduce the number of joints, save the cost of many fittings.

And the joints you *do* make with Chase Copper Tube fittings are leak-proof and strong as the tube itself!

A radiant heating installation of Chase Copper Tube and solder-joint fittings is pressure-tight for *good*...it's a job you can be proud of!

Ask your Wholesaler for Chase Copper Tube and Fittings.

Chase

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

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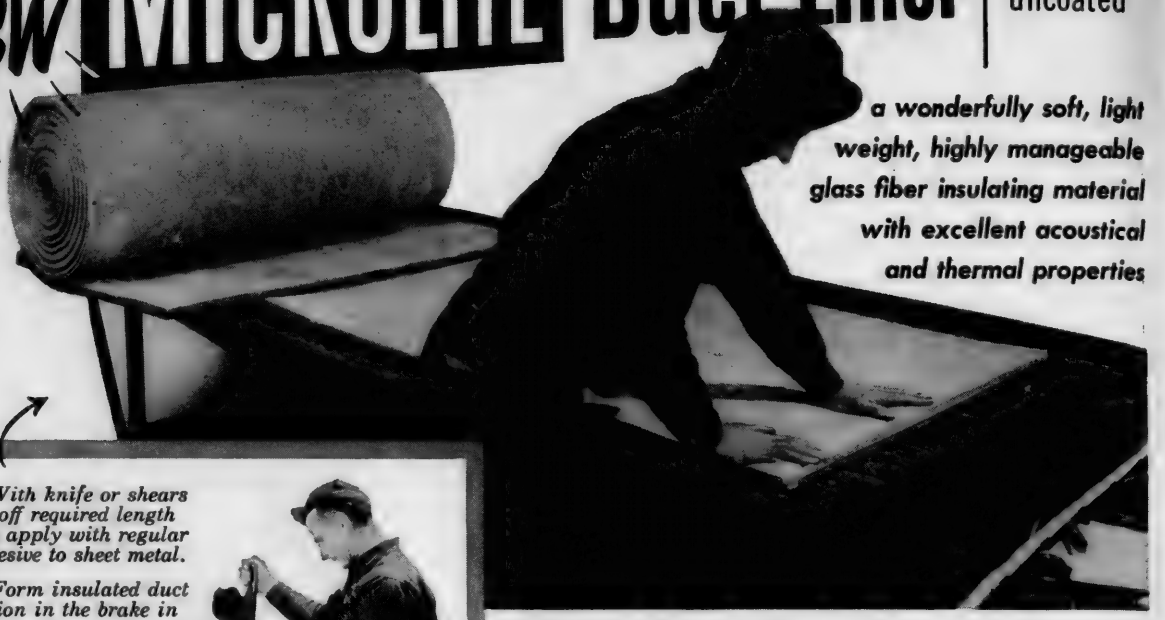
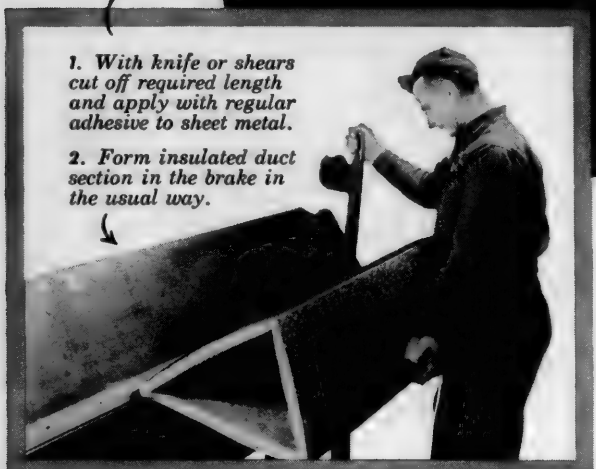
Atlanta	Cincinnati	Detroit	Los Angeles	New Orleans	Providence	Seattle
Baltimore	Cleveland	Houston	Milwaukee	New York	Rochester†	Waterbury
Boston	Dallas	Indianapolis	Minneapolis	Philadelphia	St. Louis	(†sales office only)

If your business is insulating ducts, here's important news:

New MICROLITE Duct Liner | coated or uncoated

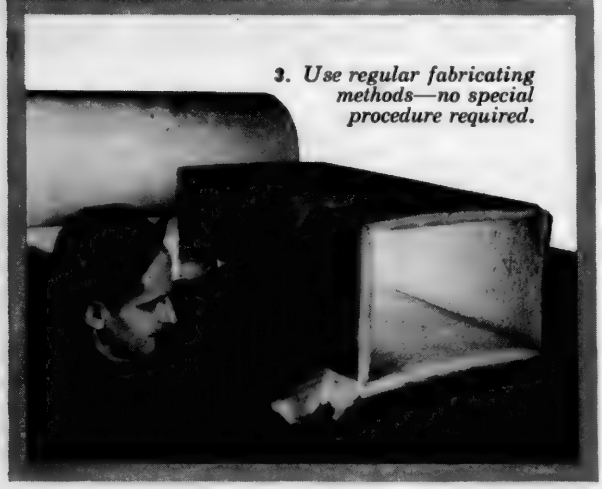
a wonderfully soft, light weight, highly manageable glass fiber insulating material with excellent acoustical and thermal properties





1. With knife or shears cut off required length and apply with regular adhesive to sheet metal.

2. Form insulated duct section in the brake in the usual way.



3. Use regular fabricating methods—no special procedure required.

Now, Glass Fibers Inc. brings you a duct liner that is a pleasure to handle and install, and is a highly efficient acoustical and thermal insulator. Chalk up another achievement for Glass Fibers' exclusive Electronic-Extrusion process, which makes possible the long, uniform fibers responsible for the insulating and mechanical superiorities of this new duct liner.

Sound Absorption Value is excellent: ½" liner has a noise reduction coefficient of .60; 1" of .75.

Thermal Qualities are also excellent: "k" value of .20 at 50°, .21 at 75°, .23 at 100°, .27 at 150°, .31 at 200°.

Light Weight: 1" liner with coating on one side weighs less than 2¼ ounces per square foot.

Air Erosion Resistance: Microlite coated duct liner is recommended for air velocities of 1500 feet per minute or over. For movements up to 1500 feet per minute, uncoated will perform satisfactorily.

Can Be Formed in Brake: Cut required length with knife or shears; apply to sheet metal with adhesive; insulated duct section can then easily be formed in the brake. On large ducts, upper surface of horizontal runs should be applied with adhesive plus mechanical clips.

Ready Made Ducts and Fittings: Microlite duct liner can be installed by the "wrap-in" method, using regular adhesives. Precision cutting and fitting of separate pieces, as in the use of rigid insulation, is not necessary.

Microlite Duct Liner is available in 24", 36" and 48" widths; half inch in 200 foot rolls; one inch in 100 foot rolls.

For a technical bulletin and sample, and name of your nearest distributor, write to Glass Fibers Inc., 1810 Madison Avenue, Toledo 2, Ohio.

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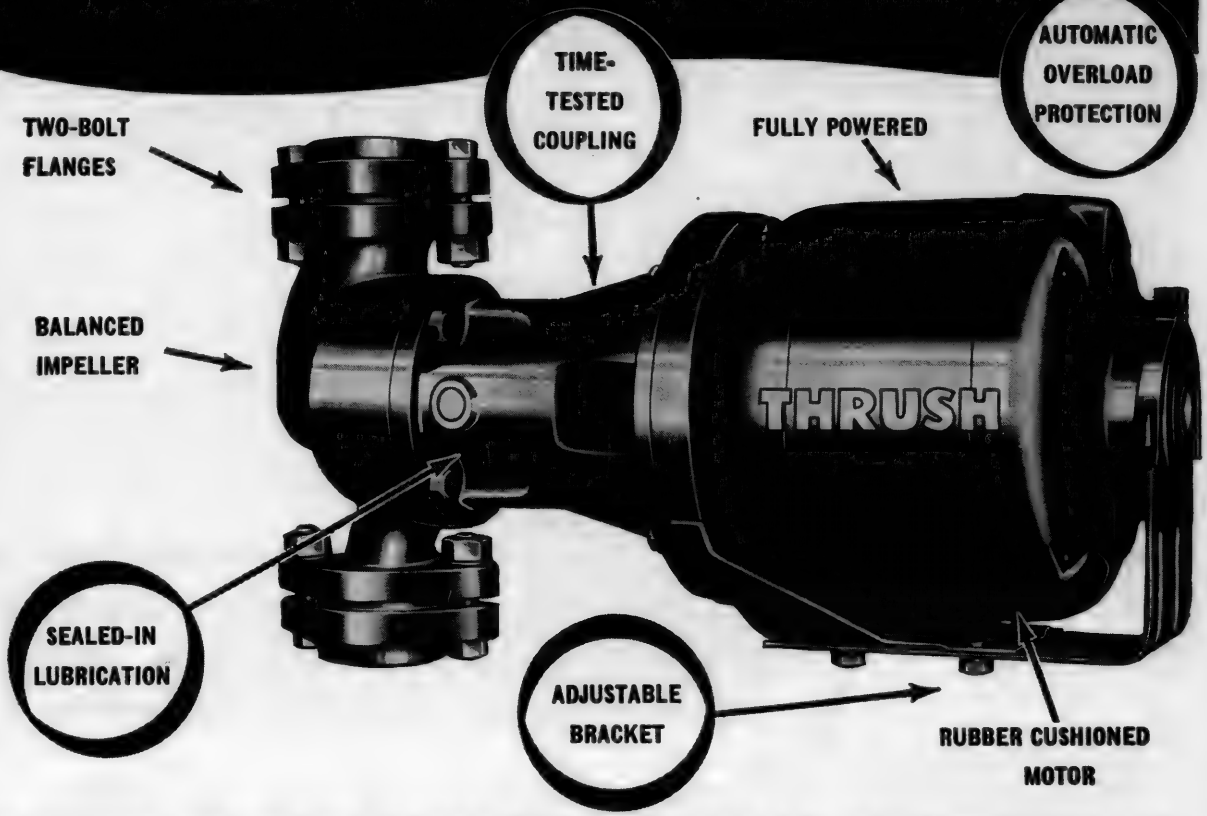

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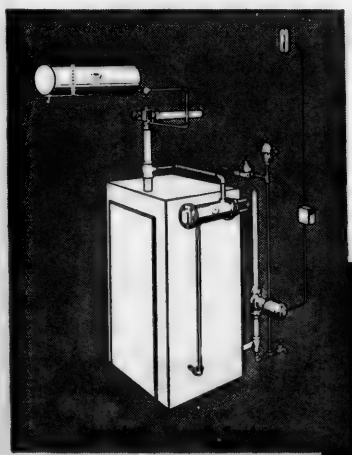
FOR REAL dependability and fine performance choose Thrush Water Circulators. Time-tested design, improved in efficiency, increased in capacity, with job-rated power for each size . . . Thrush offers the greatest value per dollar in Circulators today.



The rubber-cushioned motor mounting eliminates noise and vibration. The adjustable bracket makes motor change easy. The patented spring coupling transmits power evenly. It's trouble-free. Lubrication is sealed in . . . with double seals that rarely if ever need replacement.

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Now- SUPER-CLEAN AIR For the Smaller Commercial Installations!

ELECTRO-KLEAN—a compact, high efficiency electronic filter, complete with power pack, which lends itself to a wide variety of small commercial air cleaning operations.

ELECTRO-KLEAN, with access panel removed, showing arrangement of disposable unit-type filter cells containing a special pleated glass media.

AAF Electro-Klean Dry-Type Electronic Air Filter Designed for Unit or Zone Air Conditioning and Packaged Air Handling Units

Small size is no longer a limiting factor in the use of electronic air filters. Beauty shops, drug stores, specialty shops, office suites—all can now enjoy the full benefits of super-clean air. And, whether it's unit or zone type air conditioning (1½ to 25 tons capacity) or a packaged air handling unit, there's an Electro-Klean electronic filter of the right capacity for the system.

Electro-Klean is designed for easy installation and trouble-free operation. In hermetically sealed power pack, vacuum tubes are replaced by selenium rectifier. Having no ionizer, the problem of broken ionizer wires is eliminated. Because Electro-Klean is a dry-type precipitator, no water or sewer connections are needed; no oil is required to retain the precipitated dust. Maintenance, by unskilled labor, is reduced to the simple, periodic replacement of the filter cells which returns filter to its original condition.

Electro-Klean is available in increments of 300 cfm—which means no job is too small for super-clean air. For complete product information, call your local American Air Filter representative or write direct.

AAF **American Air Filter**
COMPANY, INC.

American Air Filter of Canada, Ltd., Montreal, P. Q. • 294 Central Avenue, Louisville 8, Kentucky

The Carnegie Endowment International Center

United Nations Plaza, New York. **Architects:** Harrison & Abramovitz; **Mechanical Engineers:** Syska & Hennessy; **General Contractors:** Caldwell-Wingate Co.; **Heating & Air Conditioning Contractors:** J. L. Murphy, Inc.

How to air condition an 11-story building *that's only 10 stories tall*

THERE is a trend toward lower ceiling heights, to reduce building costs and make rooms look "friendlier." Following this movement, the Carnegie Endowment International Center has low 9-foot ceilings. As a result the 11-story building was fitted in a normal 10-story building shell.

Low ceilings, however, create air conditioning problems. They cannot be furred down to hide the ductwork necessary for most air conditioning systems. *But, the American-Standard Remotaire system does not require bulky ducts.* One pipe carries chilled or hot water from a centrally located plant to each individually controlled Remotaire unit in the building.

Remotaire units condition the air through 4-row coils, and circulate it through the room. They filter and blend room air and fresh air.

Remotaire units come in 200, 400 and 600 cfm capacities. They can be recessed in the wall, either completely or partially, or left free-standing. Handsome steel jackets can be painted if desired.

Installation and maintenance of Remotaire units is easy. Plenty of wrench space is provided to make pipe connections. Motor and fan assemblies can be removed as a unit. Coils can be reversed for left or right-hand connection.

For more information about Remotaire send for descriptive literature . . . Form 417. **American Radiator & Standard Sanitary Corp.,** Dept. HV-84, Pittsburgh 30, Pa.

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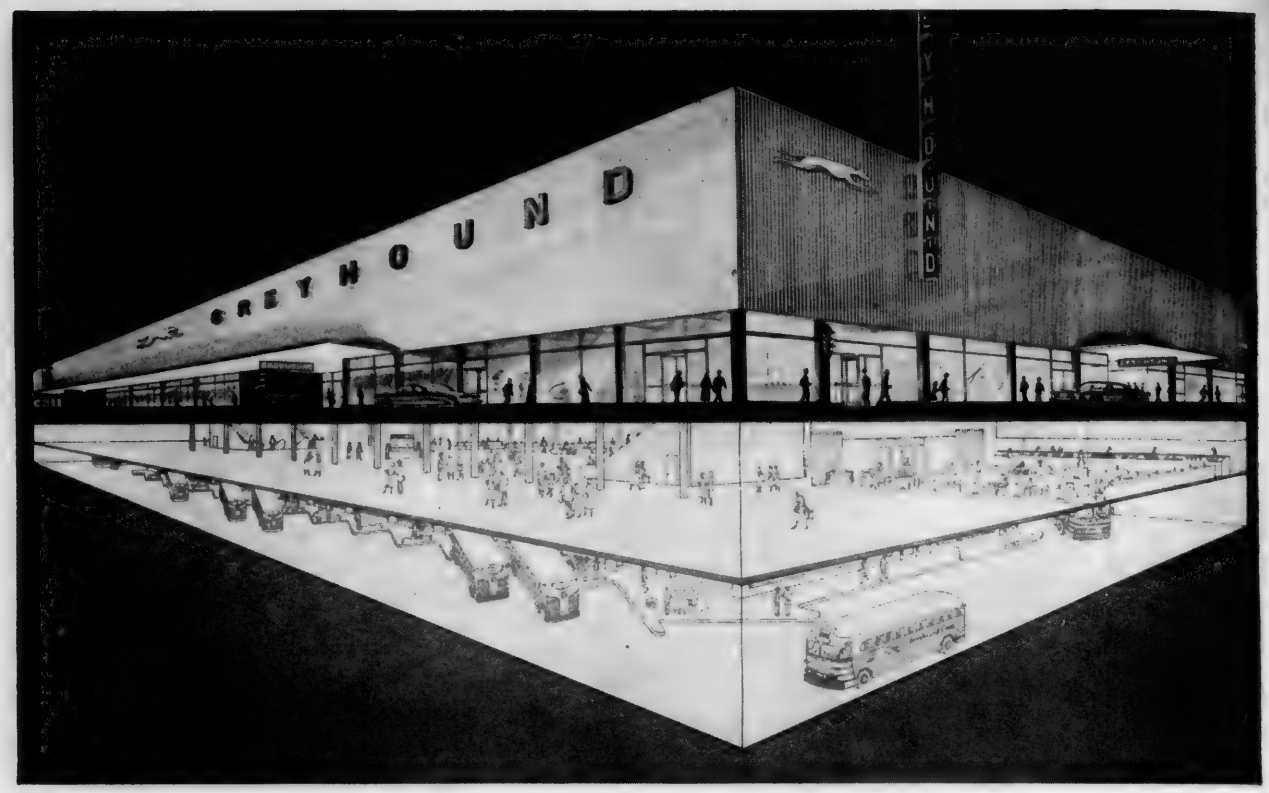
WATER HEATING-COOLING SYSTEMS

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS



GREYHOUND'S NEW CHICAGO TERMINAL • OWNER: CHICAGO GREYHOUND TERMINAL, INC.

ARCHITECTS-ENGINEERS: *Skidmore, Owings & Merrill, Chicago*
GENERAL CONTRACTORS: *John W. Harris Associates, Chicago*
HEATING CONTRACTOR: *Gallaher & Speck, Inc., Chicago*
VENTILATING CONTRACTOR: *Mehring & Hanson Co., Chicago*

New Greyhound terminal has basement in the "attic"

AMERICAN BLOWER equipment helps provide country-fresh conditioned air for Greyhound's unique new Chicago depot

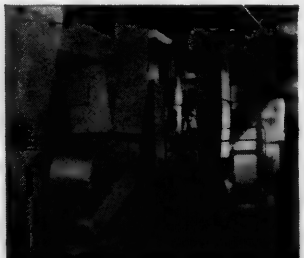
How do you build a bus terminal in downtown Chicago and avoid "Loop" traffic jams? Greyhound used a unique design, with bus tunnels 25 feet below street level. The resulting ventilation problem was solved with American Blower equipment.

For the bus-concourse level, with its open-ended tunnels, had to be cleared of exhaust fumes — to keep them from filtering up into the air-conditioned waiting room, restaurants and shops.

To overcome this obstacle, and save valuable space, air-handling equipment was installed in the top levels — putting equipment, usually in the basement, up in the "attic." American Blower Fans exhaust fumes and stale air from all levels, and circulate clean, conditioned air — slightly pressurizing the building, and creating an ideal indoor climate.

Perhaps American Blower can help *you*. Each of our representatives is a qualified engineer, with a complete knowledge of air handling and air conditioning equipment—and is prepared to give "on the spot" information.

Modern waiting room is two floors high. Greyhound terminal is geared to handle 120 buses an hour; 18,000 passengers daily.



American Blower equipment in this building includes: 22 HS Fans, 9 Air Conditioning Units, Utility Sets and Ventura Fans.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
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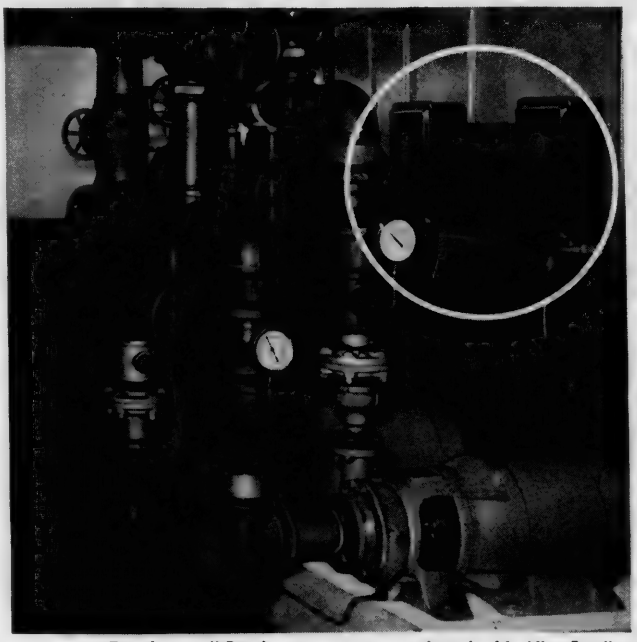
INGERSOLL-RAND MOTOR PUMPS operated by

ALLEN-BRADLEY

TROUBLE FREE MOTOR CONTROLS



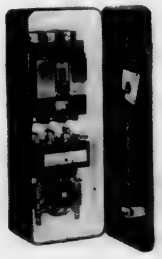
Two Ingersoll-Rand motor pumps, equipped with Allen-Bradley control, serving a cooling tower in a large office building.

TYPICAL ALLEN-BRADLEY REFRIGERATION CONTROLS

SPECIAL REFRIGERATION CONTROL UNIT

PRESSURE AND TEMPERATURE CONTROLS

MANUAL STARTER



COMBINATION STARTER

● Why are Allen-Bradley automatic starters so popular for refrigeration and air conditioning service? . . . Because they are trouble free.

Why are they trouble free? Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them! No contact maintenance . . . Allen-Bradley cadmium silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after years and years of service.

The Allen-Bradley trademark stands for millions of trouble free operations. Specify Allen-Bradley controls, today.

Allen-Bradley Co., 1330 S. Second St., Milwaukee 4, Wis.

A-B Quality

ALLEN-BRADLEY SOLENOID MOTOR CONTROLS

QUALITY MOTOR CONTROLS FOR HEATING, VENTILATING, AIR CONDITIONING, & REFRIGERATION INDUSTRIES

THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS

It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
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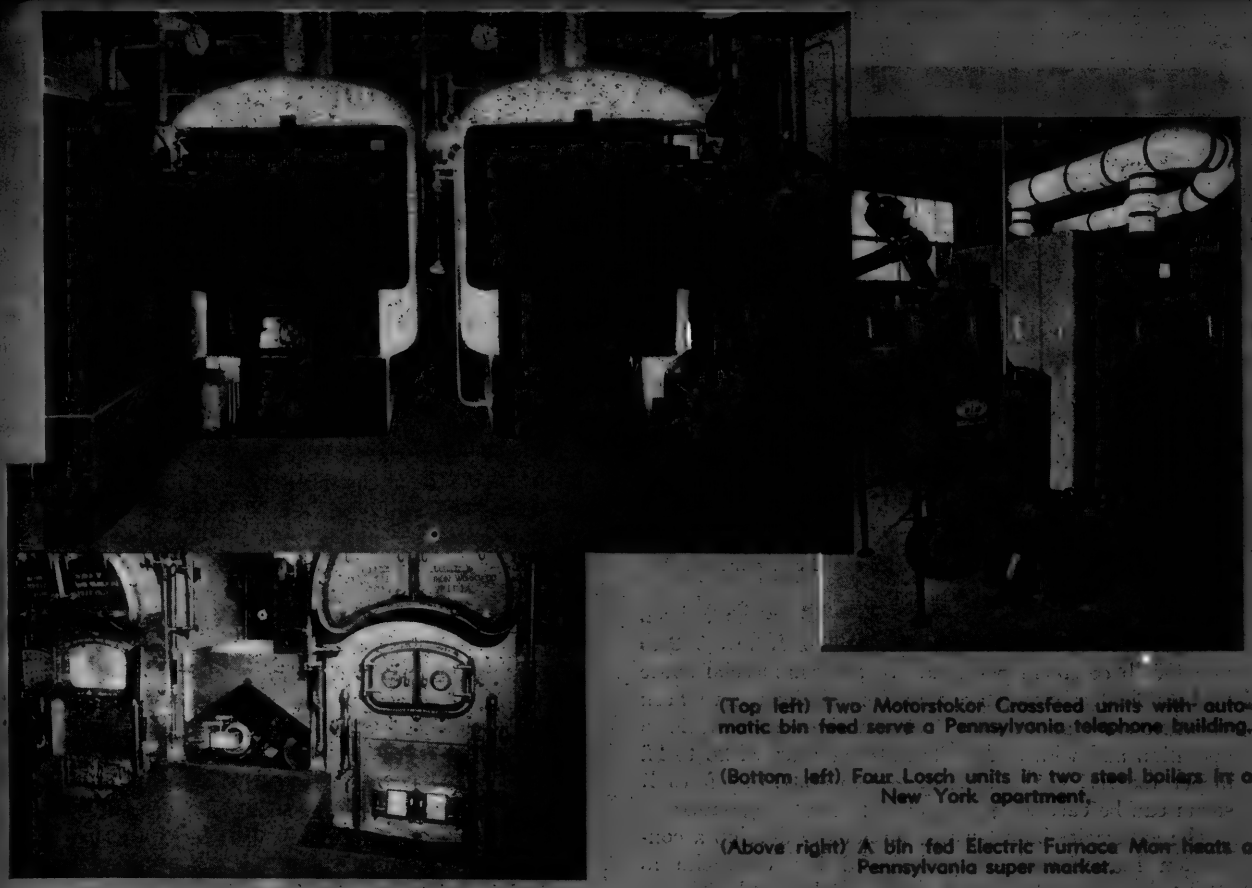


(Top left) Two Motorstokor Crossfeed units with automatic bin feed serve a Pennsylvania telephone building.

(Bottom left) Four Losch units in two steel boilers in a New York apartment.

(Above right) A bin fed Electric Furnace Man heats a Pennsylvania super market.

New Automatic Anthracite Equipment
for Commercial and Semi-Industrial Fuel Users

NORMAN C. CURTIN
Engineer, Anthracite Information Bureau, New York

One of the latest developments in the commercial heating field has been the recent introduction of modern conversion burners for the automatic use of anthracite (hard coal) in large buildings. This equipment offers advantages in efficiency, lowered installation, maintenance and fuel costs, and in the inherent qualities of anthracite fuel.

NEW types of automatic burners have been developed around the new mechanical cross feed air cooled grate and the gravity feed water-cooled grate in both conversion and integral boiler units. Models of these conversion units operate at 100 to 300 lb per hr with capacities ranging from 3,000 to 10,000 sq ft EDR steam. Integral boiler-burner units have a capacity range of from 1400 to 8400 sq ft of steam radiation.

The application of automatic anthracite stoker firing, together with automatic ash removal, is a decidedly new development in the building and heating field and a number of successful installations throughout the Northeast have demonstrated the economy of the method.

Builders and owners, who have been sold on the heating and smoke-free qualities of hard coal and the low cost of its small steam sizes, now can take a second look at janitorial costs since they no longer involve hand firing, ash removal or manual draft control. Low initial and installation costs, too, help make the modern commercial anthracite conversion burner an economical, clean and convenient method of converting to—or installing—completely automatic heating systems.

Several earlier developments were the forerunners of today's anthracite systems for large buildings. Stoker firing of anthracite in small home heating plants was introduced in 1925 with capacities ranging from 300 to 3,000 sq ft of steam radiation. Automatic feeding was accomplished by straight line screw conveyor from fuel bin to boiler. Ash removal was by spill-over from the edge of the retort to the base of the boiler from which ash was removed manually by mechanical screw or scraper elevator to sealed dust-tight containers outside the boiler. Recent developments in residential units include integral boiler-burner designs and a vacuum system of ash removal which handles the ash in sealed tubes from the boiler base to receptacles outside the home.

Newly developed Losch boiler-burner unit for large buildings features automatic anthracite feed and ash removal.

Chain grate and traveling grate stokers have been available for years serving larger boilers from 3,500 to 100,000 lb of steam per hour. In the commercial space heating field, rectangular underfeed designs have been available since about 1938. These designs are flexible in operation and with anthracite burning rates of 20 to 22 lb per (sq ft), (hr), loads of 400 to 46,000 sq ft EDR steam can be carried.

The anthracite industry was anxious to develop a conversion burner exclusively designed for anthracite to meet the capacity demand of commercial space heat users and small industrial process steam generating plants. Research was begun by several manufacturers immediately following the conclusion of World War II.

A survey of consumer requirements of commercial space heating fuel users revealed to the anthracite industry and development engineers that any new equipment should meet the following requirements:

(1) *Low initial costs.* This factor is especially important to apartment house managers and owners because of rent ceilings. Initial investments can be made only if proportionate savings in fuel and labor can be realized.

(2) *Low service-maintenance costs.* Where large annual quantities of fuel are automatically fired, this becomes an important factor in the total over-all heating cost.

(3) *Simplicity of design.* Commercial users generally must rely on semi-skilled operators who can be trained to service and maintain boiler room equipment.

(4) *Flexibility of application.* Existing boilers in good condition and properly maintained cannot be discarded where automatic firing is needed. A conversion unit to make such boilers automatic was found to be desirable.

(5) *High operating efficiency.* High over-all efficiency with minimum attention to fuel and air adjustments is paramount because of the effect on both fuel consumption and on coordination of other custodial duties around the building.

(6) *Automatic control at varying loads.* A unit which can automatically adjust to varying demand without manual readjustment is proved important also.

(7) *Capacity range—3,000 to 20,000 sq ft EDR steam.* Between the home boiler and high pressure steam generating station, about 80% of all commercial space heating requirements fall within this range.

To take advantage of anthracite's smokelessness, high carbon, and low sulphur characteristics, it was felt that an entirely new basic design which completely eliminated moving parts in the fire zone should be developed. The result was today's gravity feed water-cooled and mechanical feed air-cooled grates.

Gravity Water-Cooled Grate

The Losch Boiler Company of Summit Station, Pa., had developed an integral boiler burner unit using the cross feed principle on a water-cooled grate. Its maximum capacity was 7,200 sq ft EDR steam. It was, therefore, felt that research should be directed towards development of a conversion water-cooled grate which could be applied to all conventional cast iron and steel boilers up to capacities of 20,000 sq ft.

The grate, which has been developed by Losch and Electric Furnace-Man, Inc. of Emmaus, Pa., consists of almost flat steel plates (angle is lowered 7° from the horizontal feed end to the discharge end). It is made of ¼-inch steel plate with 3/32-inch holes drilled on ¾-inch centers. A water chamber ¾-inch deep located under the grate is supplied by water from the boiler through flexible connections. The water reaches the grate at the upper end and is circulated by gravity into the boiler below the water line. In this manner, heat from the fuel bed is added to the boiler water and in many cases actually increases the rate of output of the boiler by some 10 to 15%. Application is limited to low pressure heating boilers.

Coal is fed by gravity from a hopper running along the length of the boiler to the grate. The grate is suspended on hangers so that it can move freely. A cam which is connected to the gear box of the drive unit is so arranged as to actually reciprocate the grate, thus creating movement of fresh fuel across the retort where it is burned and at the same time discharging the ash from the free end to specially-designed containers located at the base of the boiler. The total width of the active grate area from the time the fresh coal enters until it is discharged as ash is 16-inches. The total movement of the grate is ¼-inch, so that the feed can be regulated by the number of reciprocations and can be set to move the grate once every 40 seconds for maximum movement and once every

At New York equipment show, model points out features of Motorstokor Crossfeed manufactured by Hershey Machine and Foundry Co.

Norman C. Curtin received his B.S. in Mechanical Engineering from Carnegie Institute of Technology in 1924. He served as field engineer and supervisor of field engineers for Anthracite Institute from 1926-1953. He joined the staff of the newly formed Anthracite Information Bureau in January, 1954 and serves as engineering consultant and technical advisor.

80 seconds for minimum movement. Intermediate positions provide regulation in accordance with the burning rate to be maintained and the heating load to be carried.

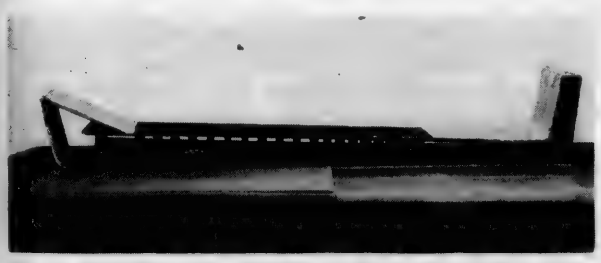
The water-cooled grate itself eliminates moving parts in the burning zone and provides a relatively trouble-free automatic anthracite burner. Over-sized foreign matter will not make the grate inoperative, and adjustment by the operator will not be necessary after it has been properly set by the installer. While the grate width is limited, there is no limit to the length. For this reason, where fire box dimensions permit, a conversion grate can be installed on either or both sides of the boiler. As a result of maintaining a thin fuel bed, a continuous burning rate of 30 to 32 lb per (sq ft) (hr) can be sustained without the development of excess air as a result of uneven distribution in burning. Field tests indicate boiler and furnace efficiencies will average from 75 to 82%.

Mechanical Cross-Feed Air-Cooled Grate

The Motorstokor Division of the Hershey Machine & Foundry Company of Manheim, Pa., entered the commercial burner field with the development of a cross feed conversion unit using air cooled tuyeres rather than water-cooled systems.

Several problems presented themselves during the research and development stages of this burner. Very few data were available on coal feed rates on a stationary horizontal surface. It was felt that a burning rate of 30 lb per (sq ft) (hr) must be developed. Early designs indicated that while high volatile anthracite could be satisfactorily used, low volatile anthracites resulted in deep fuel beds, shutting off of air, and development of clinkers.

Original designs were changed to give the grate a slope of 15° but it was felt that this had no particular advantage. Research discovered that the real difficulty was in the design of the tuyere which was resulting in a building up of fire bed temperature while clinker formation was preventing uniform distribution of the fuel. Coal was being fed by plungers at the level of the fuel bed so as to create, in effect, a fluid bed in the retort.



Cross-section of water cooled grate showing vertical air tubes passing through narrow water way.

There was finally developed a cast iron high silicon tuyere bar 14 inches in length with an extra-long cooling fin, so cast as to provide pads between the tuyere bars. The total free area of the grate was a maximum of 5%.

In order to insure uniform fuel bed thickness throughout the length and width of the grate, a twin worm feeding system was developed. Coal is picked up from a universal bin feeder and discharged into a hopper box, thus preventing feeding of the coal directly from above to the supply worm. The supply worm is designed with a capacity slightly in excess of the four plungers so as to insure uniform supply of coal throughout the length of the retort. To prevent overfeeding of coal at the remote end of the supply worm, a reverse flight worm picks up the excess coal and returns it to the hopper box.

In this design, all moving parts are outside the burning zone. The tuyere design is free from metal growth and wear and service costs are low. Both high and low volatile anthracites are successfully used.

There are no obstructions in front of the boiler since the conversion burner can be installed from either side. Capacities of present installations are 200 lb of coal per hour for the two-section unit and 300 lb of coal per hour for the three-section unit. Application may be made to high and low presssure boilers.

Selection of Fuel and Equipment

A number of factors must be recognized as important considerations affecting the selection of fuel burning equipment for any building. The new conversion burners for the automatic use of hard coal have been designed to fulfill each of the following requirements.

Automatically-fired anthracite will operate at an efficiency equal to that of any other fuel. This statement is supported by the results of many boiler tests conducted by reputable and impartial engineering firms. The efficiency of these new anthracite burners in their present installations has been of particular interest to contractors and engineers.

Results obtained from tests in the steam plant in an eastern college showed boiler efficiencies of 71.1 and 74.8% with ample excess air (179% and 50% respectively) and moderate losses due to combustible in refuse

Viewing the grate side of the Electric Furnace Man conversion unit.

Losch conversion units at Westover Airforce installation.

CAPACITIES OF AUTOMATIC ANTHRACITE EQUIPMENT

Manufacturer	Capacity, Sq Ft EDR Steam	Size of Anthracite Used	Automatic Features
Electric Furnace-Man, Inc., Emmaus, Pa.	*3,600-10,350	No. 2 or No. 3 Buckwheat	Universal bin feed auxiliary. Gravity ash removal.
Losch Boiler Co., Summit Station, Pa.	*2,980-10,400	No. 2 or No. 3 Buckwheat	Universal bin feed auxiliary. Gravity ash removal.
Motorstokor Div., Hershey Machine & Fdry., Manheim, Pa.	6,500-9,750	No. 2 Buckwheat	Integral universal bin feed, gravity ash removal.

*Multiple burners can be installed where firebox dimensions permit. In such cases, outputs can be increased two to four times those shown in the table.

(4.5% and 8.0%) at medium firing rates of 16.7 and 22.3 lb per (sq ft) (hr). Actual steam production was about 9 lb of steam per lb coal of 12,500 Btu heat value.

Anthracite Institute Laboratory tests of the mechanical air-cooled grate, at burning rates of from 17.0 lb per (sq ft) (hr), to 29.8 lb per (sq ft) (hr), with a wide range of volatile characteristics, showed percent CO_2 from 10.5 to 13.6%.

A special application to a corn drying operation by the Penna. Farm Bureau developed the following test data. Over a period of 30 days, combustible in the ash averaged 11%, CO_2 9.75%, boiler and furnace efficiency 77.5%.

Anthracite Institute field test using two 9-sq ft water-cooled grates installed in each of two fire tube boilers, at 21.3 lb per (sq ft) (hr) showed the following readings:

Loss due to carbon in ash, %	1.93
Dry flue gas loss, %	8.12
Loss due to incomplete combustion as CO, %	1.82
Loss due to moisture in fuel, %	.60
Total accounted for losses, %	12.67
Boiler efficiency, %	87.33

The cost of maintaining fuel burning equipment is a very important factor to be considered when selecting fuel and equipment. Modern anthracite equipment is basically simple. It is rugged in construction with few adjustments necessary and with a minimum heat exposure to moving parts. In addition, anthracite is low in sulphur and water content, and therefore does not have a tendency to form acids that attack the breeching, boiler settings, and mortar of masonry chimneys. Parts replacement and maintenance costs are low.

The application of modern anthracite coal handling and ash removal systems will permit custodians to perform their boiler room duties as well as other regular chores. Labor costs are no more and in many instances are less than those required for the proper handling of other fuels.

Cities are becoming more and more aware of the necessity for smoke abatement rules and regulations for cleanliness and health. Anthracite does not smoke nor form soot. While it is possible to burn other fuels smokelessly, to do so requires added expense in constant supervision of the critical fuel and air ratio. On the other hand, anthracite does not create soot under any burning conditions.

The anthracite marketing area is served by one of the world's greatest transportation networks, the Eastern railroads, which assures supplies at all times and in all kinds of weather from the mines in nearby Eastern Pennsylvania. Local supplies are also dependable at all times through large storage facilities in dealers' yards in small rural as well as large urban areas.

Contrary to some impressions, work stoppages have not affected the dependability of anthracite for more than 25 years. The fact is, the industry has been practically strike-free since 1926. Anthracite has reserves underground for more than 150 years' supply.

In new construction, fuel cost comparisons should be made on the basis of equal reserve storage. For example, a 60-ton bin filled with anthracite is equal in heat content to 10,000 gallons of fuel oil. Ample storage space to accommodate a full year's supply of coal may be constructed at a cost far less than storage facilities for other fuels.

Transportation is a major factor affecting fuel costs. Costs will vary, almost from county to county, depending on the distance from the original source of supply. On a basis of heat content, therefore, anthracite enjoys a price advantage in almost all sections of its primary marketing area, the Northeastern seaboard, which is in close proximity to the mines of eastern Pennsylvania.

Since comparable costs will depend also on the sizes of anthracite and the kinds of other fuels being considered, the following ratios can be used for making local comparisons:

Rice anthracite contains 25,000,000 Btu per ton; barley anthracite 24,000,000 Btu per ton. Based on the established Btu content of various grades of oil (138,500 to 152,000 Btu per gallon), and natural gas (1,000 Btu per cu ft), comparative fuel costs can be determined.

In installations involving sudden changes in heat output, acceleration can be an important factor in the selection of fuel and equipment. An acceleration test of the mechanical cross-feed stoker showed increase in burning rate from zero to maximum in less than 30 minutes.

To assist heating contractors all manufacturers of the water-cooled and mechanical cross feed burners supply factory engineers to supervise the work on the first ten units installed by newly franchised dealers.

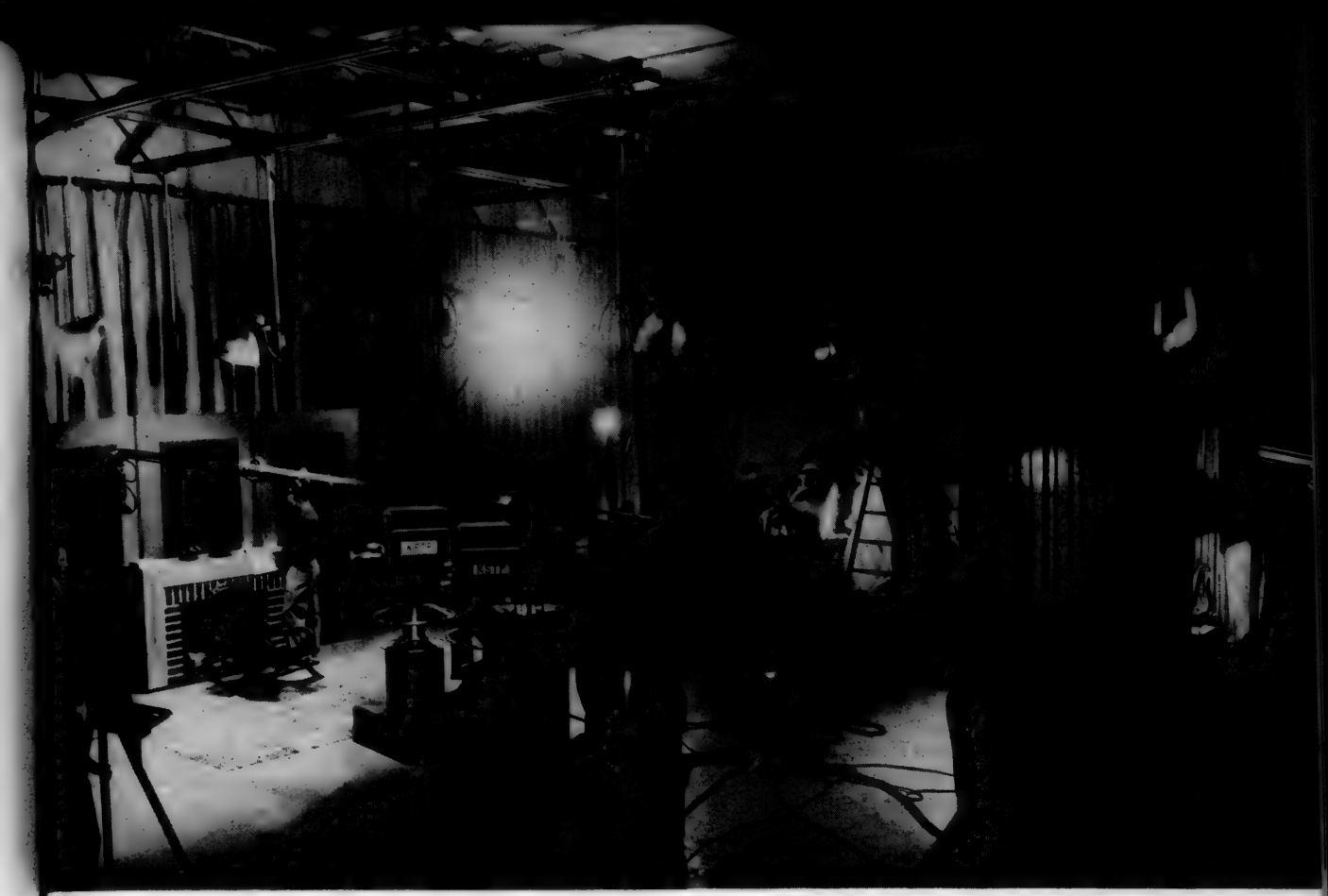


Fig. 1. Main studio of KSTP-TV, designed especially for color television, has triple lighting capacity of black and white studios.

Air Conditioning Design for a Color Television Studio

C. L. RINGQUIST
Engineering Department, The Trane Company, La Crosse, Wis.

Problems in the air conditioning of a color television studio are covered through a description of the design for the new KSTP-TV studio. Not only is it important to remove the excessive heat from the many lights, but air velocities must be low to prevent movement of scenery and costumes. Similar to other broadcasting stations, noise transmission must be checked.

As color television becomes perfected, both networks and independent stations throughout the country will either convert black and white studios for color telecasting, or will build new studios for this purpose. Air conditioning is essential for these new studios, because color TV requires up to three times the lighting needed for convential television. Without air conditioning, the heat from banks of 2,000-watt lights would cause performers' make-up to run and would reduce the quality of their performance.

The many problems of air conditioning a color television studio, and how to solve them, can best be illustrated by a recent installation in the large new color TV studio of station KSTP-TV in Minneapolis and St. Paul. Methods of distributing air, reducing noise, and controlling the air conditioning system were worked out to meet (1) strict noise limitations, (2) a requirement for 15 air changes per hours, and (3) highly fluctuating cooling loads.

The new studios are used primarily for black and white telecasting, although an occasional compatible color telecast is made. However, when color TV becomes widespread, the new KSTP-TV studios will have the extra lighting and cable facilities to initiate local or network color telecasts from the Twin Cities. The new KSTP-TV facilities are said to be the first full-scale color television studios in the country to be built by an independently owned station.

This new studio addition includes two large color TV

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He is a member of ASHVE and the author of numerous papers and articles on air conditioning and heat transfer process applications.

studios, offices, control rooms, toilets, dressing rooms, property and air conditioning equipment rooms. The addition is a complete TV station in itself, separate from the old KSTP-TV studios and their standard broadcasting facilities.

The larger of the two studios, called Studio F, is 53 ft x 50 ft x 21 ft high. The smaller studio, Studio E, is 41 ft x 25 ft x 13.5 ft high.

The machinery room containing the air conditioning equipment is located at the second floor level adjacent to the north wall of Studio F, and is 30 ft x 25 ft x 8 ft high. Under the equipment room runs an 88 ft x 24 ft property room, (not air conditioned). Details of the two floors are shown in Figs. 2 and 3.

Also on the first floor level, and adjacent to the property room, is the smaller Studio E. Above the property room and Studio E is a main office 58 ft x 25.5 ft and four 10 ft x 10 ft executive offices. Next to the small offices, along the east wall are two toilets and dressing rooms. A 32 ft x 12 ft corridor separates the small offices and dressing rooms from the main studio second floor level. A bank of double-thickness glass windows overlook the main studio at this level so visitors can view studio activities during telecasting without mixing with the studio audience. All of this area is air conditioned.

Three control rooms are provided for monitoring and controlling the telecast. The larger control room is used by the video director, and contains the monitoring sets and picture effect controls. This room is 16 ft x 14 ft x 8 ft high. Two smaller control rooms are occupied by an audio control operator and an announcer, respectively, and are 14 ft x 10 ft x 8 ft high.

Air Movement Problems

When designing the air conditioning system, one basic requirement was to keep air movement below 25 fpm within a zone up to 12 ft above the floor level.

It was found by experience in KSTP-TV's older studios that velocities above 25 fpm would cause movement of performer's hair and clothing. Higher air velocities from diffusers or registers, and air turbulence and eddy currents would also cause movement of properties used on television sets.

For example, most of the stage props used on television sets are highly expendable and so are flimsily built of thin canvas and light plywood. "Profile two-folds" of this materials, so called because a three-dimensional effect is created on the set and because they can be folded away, are easily moved by air currents. Profile two-fold trees, fences, houses and other objects must not move during the telecast.

Again, canvas roll drops, with scenes painted on them much like the backdrops used in old fashioned movie houses, act like huge sails that catch and sway with the slightest air motion. It would not do for a skyscraper painted on a roll drop to begin swaying.

Another item used on sets, also effected by air movement, is the Trans-lux projection screen, upon which are projected moving scenes from the rear. This unit can be compared to the canvas roll drop when enumerating the studio equipment affected by air movement.

Noise Problems

Both the new studio building and its air conditioning system were designed to maintain noise within the studio below a condition termed "program zero." Noise from the air conditioning equipment added to the studio must be kept below the average program noise level.

The noise problem was complicated by two factors:

(1) Studio program noise levels vary, depending upon the type of program. A high sound level program such as an orchestra would drown out any extraneous studio sounds. But a program scene in which the set is relatively quiet, such as a sequence in which a burglar creeps around a silent house, demands a very low noise level from air conditioning and other studio equipment.

(2) Microphones must be hung on booms to keep out of the camera range. This means that the microphones must be very sensitive and highly directional and they must feed into a "high gain" amplifying system to pick up sound from the performers who are often from 6 to 10 ft from the set. Noise from overhead diffusers will be easily picked up by the microphones, since they are never very far from the overhead ductwork, as will be seen later when the air conditioning system is described.

Ordinary noise measurements with sound level meter networks that approximate the frequency and intensity response of the human ear, could not be used for the human ear was not the governing criterion. Since the studio microphones are the ears that pick up noise, sound measuring apparatus had to be used that corresponded to the frequency and noise response of these microphones.

For example, at low sound levels the human ear tends to hear well only the middle range of frequencies. Above and below this range, the human ear tends to be quite insensitive. The studio microphones, however, have a flat frequency response from 20 to 15,000 cycles per second.

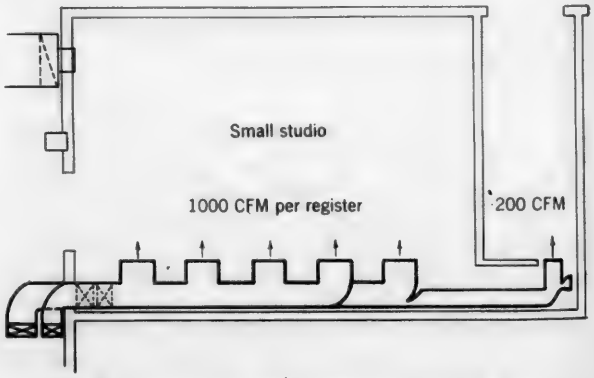
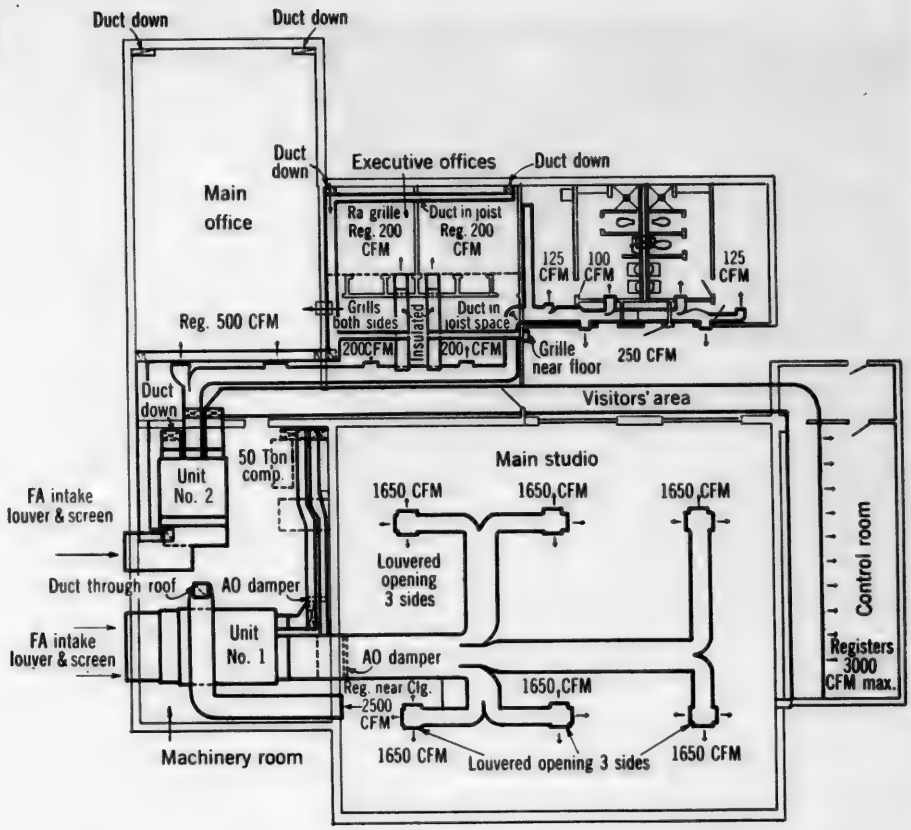


Fig. 2. Plan of the small studio on the first floor.

Fig. 3. Second floor plan of the main studio showing ducts, air outlets, and other air conditioning system details.



The sound level meters used to check noise at KSTP-TV's new studio had a similar response.

Lighting Load Fluctuates

The lighting load in the large studio at KSTP-TV was calculated as 33 kw. However, if all the studio lighting is turned on, a total of 65 kw would be in use. The 33 kw load was assumed by KSTP-TV engineers to be the largest load that would be in use. The 65 kw total would result from a wide assortment of lighting such as small and large spotlights and floodlights, most of which could not be used simultaneously because of their specialized purpose. Should the lighting load be increased over 33 kw, part of the cooling capacity for the studio not in use can be diverted to the larger studio.

The lighting load fluctuates fairly rapidly during a telecast. For example, for special effects, remotely controlled dimmer lights totaling 10 kw, are adjusted to bring up or take out the background, or to induce a silhouette effect. A bank of 2,000-watt lights can flood one scene—in the next a single spot can highlight the performer. The load can drop from 10 or 15 kw to only 3 or 4 kw and then jump to 20 or 25 kw.

The air conditioning system at this station was designed to distribute air evenly to enable the thermostat to sense these heat changes quickly and to modulate cooling capacity accordingly.

Occupancy Load Varies

Occupancy load of the large studio is based on 100 persons, including performers. Occupancy in the smaller studio is based on 10 persons including performers. On occasion the occupancy can be greater in either studio. The plan mentioned previously, whereby part of the cooling capacity for either studio can be concentrated into the studio where it is needed, provides extra capacity to either one of the studios.

For example, last January, KSTP-TV carried the color telecast of the Rose Bowl Parade and invited 870 guests for a private showing in the large studio. All 870 guests showed up. By directing all the cooling capacity for both studios to the main studio and using all outside air at 36F, the system carried the cooling load. This was an unusual situation, but it serves to illustrate the extremes of cooling load in television studios.

Air Conditioning System Design

Outside design conditions for this studio are 95F dry bulb and 75F wet bulb. Indoor design conditions in both studios are 80F dry bulb and 67F wet bulb.

In the large studio, the total sensible heat gain was 193,880 Btu per hr, of which 102,000 Btu is accounted for by the lighting load and 22,000 Btu for a 100-person occupancy load. For ventilation, 3,000 cfm of outside air is provided. The system provides 15 air changes per hour. The total latent heat gain in large studio is 93,560 Btu per hr including the necessary dehumidification of the outside air.

In the smaller studio, the total sensible heat gain is 60,511 Btu per hr, based on an occupancy of 10 persons plus 300 cfm of outside air. The total latent heat gain is 9,356 Btu per hr including dehumidification of outside air.

A two-zone factory assembled air handling unit

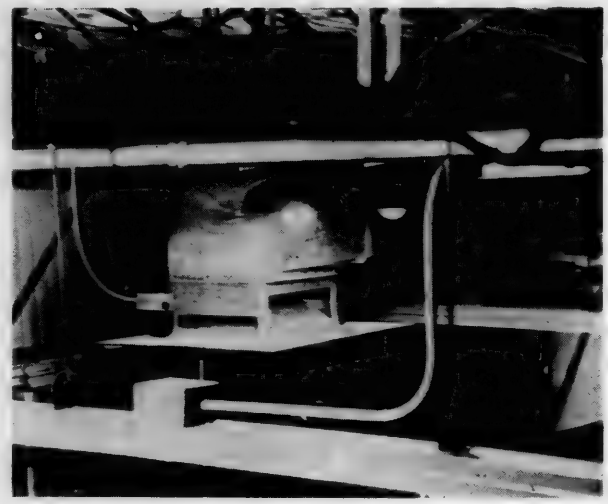


Fig. 4. Six of these square diffusers supply 1,650 cfm of tempered air to the main color television studio.

equipped with a mixing box, mixing dampers, steam heating coil, direct expansion cooling coil and cleanable filters was installed to cool and heat the two studios.

Provision was made for tying in ductwork from both studios to add two thirds of the main studio capacity to the small studio in the event of an occupancy or lighting overload. Cooling capacity of the small studio can also be funneled to the large studio for the same purpose.

Switching the cooling capacity from one studio to another is accomplished by air operated dampers located in each of 14 x 16-inch and 14 x 28-inch supply ducts to the smaller studio and in the one 66-inch x 20-inch supply duct to the main studio. The dampers are located just outside the air handling unit (climate changer). These dampers are modulated by remote pneumatic switches located in the property room just outside the small studio on the first floor. Usually it is known in advance if either of the studios will have an occupancy or lighting overload, and a technician can adjust the dampers at the switches in the property room to maintain design conditions as needed. Remote instruments at the switch location give temperature of each studio.

The factory assembled air handling unit has individual mixing dampers on each zone so each studio has individual temperature control. Capacity of unit is 12,500 cfm.

A 50-ton reciprocating compressor supplies Freon to direct expansion coils in the two-zone air handling unit and to a three-zone air handling unit that cools or heats offices, control rooms and dressing rooms. A 50-ton evaporative condenser is located on the roof of the machinery room. Suction temperature to the compressor is 45F. The three-zone air handling unit for the office has a capacity of 8,000 cfm.

Air Distribution System

As can be seen in Fig. 3, air leaves one zone of the climate changer air handling unit for the studio through a 66 x 20-inch plenum, which divides into a network of six distributing ducts to room diffusers. Each diffuser supplies 1,650 cfm.

The diffusers, Fig. 4, were specially designed for this installation because of noise and air distribution requirements. They are made of sheet metal, 18 inches square and are open on four sides. As can be seen in the photograph, air leaves through four rectangular slots. An inverted cone in the center of the diffuser is designed to split the air stream so it spreads out evenly through the slots. Air leaves the diffusers at about 600 fpm.

The diffusers accomplish external induction of the air stream by distributing the chilled air in layers over the studio. Diffuser slots are designed to retard air delivery near walls to prevent air bouncing off walls, dropping down on performers below, or causing eddy currents or turbulence leading to noise. About 75 per cent of the air leaving the diffusers is directed away from walls. This method of air distribution was found to keep velocities in the 12 ft zone above the floor, under 25 fpm.

Ductwork is hung beneath the main ceiling lights, so the chilled air does not have to pass over the hot lights. The five-foot area between the top of the ductwork and the ceiling is considered a neutral zone.

Special Exhaust System

As can be seen in Fig. 5, a 36 x 24-inch exhaust register is placed close to the ceiling to exhaust 2,500 cfm of ceiling air directly to the atmosphere. This exhaust is connected to a power exhaust ventilator located on the roof over the equipment room. Operation of an exhaust damper in this system is tied in with outside air dampers on the air handling system so that the exhaust ventilator starts when fresh air dampers open, to avoid excess air pressure in the studio. Should excess studio pressure occur when this ventilator is not running, the exhaust damper to the air will open on back draft pressure.

The hot ceiling air is removed before it can heat the ceiling and ceiling structural members and cause them to radiate heat downward. The powered roof ventilator and exhaust damper also open when the temperature of ceiling air reaches 85F. This exhaust system is estimated to reduce air conditioning operating costs about 10 per cent, according to studio engineers.

Main Studio Return System

Two return registers are placed above the property room door, about 8 ft above floor level. The reason for this location is to prevent studio personnel from blocking the return with studio props, furniture, drapery and miscellaneous material. It was found from experience in an older studio that returns near the floor were sometimes blocked by props inadvertently placed in front of the registers.

During winter months most of the cooling load can be carried by outside air, which is filtered and tempered in the climate changer air handling unit. In case of an atomic bomb attack, or motivated by another cause, pneumatically controlled outside air dampers, Fig. 6, can be closed by manual operation of two pneumatic switches in the equipment room and all air recirculated. Since the new studios are entirely without windows, the recirculation feature could have practical value.

Studio Control System

The studio temperature control system is fully automatic the year round with temperatures in each studio

controlled by individual room thermostats. When the room thermostat calls for heat, pneumatically actuated mixing dampers modulate so as to pass more air over the heating coils and less over the cooling coils in the climate changer. The reverse occurs when the room thermostat calls for cooling.

Air Control

Air entering the cooling and heating coils is controlled by a thermostat in the mixed air chamber. The thermostat modulates the fresh air damper open and return air damper closed to maintain a 45F air temperature whenever outdoor air temperatures permit.

A high limit mixed air thermostat gradually closes the outdoor air damper and opens the return air damper to maintain a maximum temperature of 80F during the summer cycle.

To maintain design conditions in the studios, it was necessary to control the leaving air temperatures from both the heating coil and the cooling coil. A thermostat in the air stream leaving the cooling coil automatically starts the refrigeration compressor to maintain 45F. A thermostat in the air stream leaving the heating coil maintains this air at 105F by modulating a steam valve in the supply line to the heating coil.

Compressor Capacity Control

The compressor itself modulates according to suction pressure. Either the room thermostat or the leaving air thermostat on the cooling coil can call for more cooling and actuate the mixing dampers to pass more air over the cooling coils. As air volume over the coil increases, suction pressure increases, which in turn starts the compressor or causes the cylinder unloaders to increase compressor capacity.

A ductstat in the supply ducts to each zone takes over temperature control when the room thermostat is satisfied, to prevent discharge air temperatures from going below 65F. This thermostat modulates the mixing dampers to discharge 65F air to the studios while they are unoccupied. This in effect pre-cools the unoccupied studio 15F under design conditions and helps to cancel out the radiant load from the lights by cooling down wall and ceiling surfaces and room furnishings.

As can be seen in Fig. 2, two ducts are taken off one zone of the climate changer air handling unit to supply five 48 x 8-inch registers located near the ceiling of the small studio. One of the ducts serves four of the registers, and each register supplies 1,000 cfm. This has been calculated to satisfy design conditions. The other duct supplies the remaining two registers, and is used only when cooling is being diverted from the main studio.

Cooling Can Be Diverted

When the studio becomes overloaded with occupants or the lighting load exceeds design conditions, volume dampers on the supply ducts from the two zones of the climate changer unit can be manually adjusted by remote operated pneumatic switches controlling pneumatic damper motors. The switches are located in the property room just outside the small studio. Up to two-thirds of the air volume can be diverted from the large studio to the small studio for this purpose. The volume dampers, located in the ducts just as they leave the climate changer, can also be adjusted to throttle down the air volume to the small studio so most of its air can be diverted to the main studio in the event of an overloaded condition above design load there.

Fig. 5. Distribution ductwork in color television studios release cooled air underneath ceiling lights. Note return register located over doorway about 8 ft above floor.

Noise Control in New Studios

This station, like other television studios, is well equipped with sound recording instruments such as decibel meters. These facilities enabled the air conditioning system installers to track down and eliminate noise throughout the system in a minimum of time.

To start with, natural attenuation (or sound absorption) of all duct work was greatly increased by a 1½-inch lining of glass wool acoustical material in both supply and return ducts and exhaust ducts. Dampers were also lined with this material. Noise from the ductwork was reduced to eight decibels.

Ductwork was supported from ceiling structural members by floating type hangers. Where ductwork goes through walls from the machinery room to the main studio or elsewhere, it is surrounded by a 2-inch covering of fiberglass insulation. Both supply and return ductwork are connected to the air handling unit by a slip joint lined with a one inch layer of felt. This permits free movement of the air handling unit and the ductwork.

The air handling unit is mounted on isomode vibration eliminator pads of rubber in shear. The compressor is also mounted on vibration isolators.

Installation of Pipe

All piping in the machinery room is mounted free of building structural members. Piping is supported by

Fig. 6. These pneumatic controls in the photograph operate outside air dampers.

floor to ceiling standards which are isolated by rubber in shear at the top and bottom. Thus there is no piping in direct contact with joists or other structural members.

The flexible pipe connections to the compressor were found to be too stiff since they transmitted vibration. This problem was solved by cutting off the armored coating on the flexible connections to increase their freedom of movement.

The air handling units themselves were sized to supply the required air supply with lowest possible fan tip speed to keep fan noise as low as possible. They were also lined with acoustical material inside the casing.

Although adjacent, the studios and the machinery room are separate buildings. The north wall of the main studio, for example, is a bearing wall of reinforced concrete, columns and steel beams. A one inch layer of fiberglass insulation is placed between the wall, columns and beams. This heavy mass of masonry and concrete isloates elements of the building that carry sound.

The walls and ceiling of both studios are surfaced with a 1½-inch layer of glass wool acoustical material which effectively dampens sound.

The machinery room is built on a separate structural frame, with heavy, reinforced concrete floor slab and joists (this room is at the second floor level over the property room) isolated from the studios. The same construction applies to the property room, which is also isolated from the studios and actually is part of the separate structure containing the machinery room.

Transmitting Tower Passes through Machinery Room

Structural steel legs of the 570 ft high television transmitting tower pass through the floor slab of the machinery room, and the room itself, as can be seen in Fig. 7. Since construction of the new station addition had to be speedy to meet program commitment schedules, the air conditioning system was being laid out at the time the building was being built.

System designers could not tell exactly where on the tower legs the floor slab would fall, and so had to select the factory assembled air handling units as the most compact equipment available to meet what they knew was to be a tight space allotment. The units did fit in, with some room to spare, as the photograph shows.

When the floor slab was poured, a 4-inch hole was left around the tower legs and later filled with acoustical plaster. This treatment prevents transmission of tower movement to the floor slab.

For example, winds in the Twin Cities area often blow in gusts up to 50 miles per hour during many months of the year. The whine of the wind as it cuts around structural members of the tower high in the air can be detected by persons approaching the station on foot. This noise would have been transmitted to the building had it not been for the isolation of the tower legs where they pass through the floor slab of the machinery room. On days of high wind velocity this whining noise can be felt as vibration by placing the hand on any of the tower legs in the machinery room.

Doors to studios are metal clad fire doors with the frame core filled with insulating material.

Searching for Noise in the Studios

Two methods were used to track down noise. Standard broadcast field equipment—a small remote audio pick-up including a microphone, pre-amplifier and volume level indicator, was used to track down noises throughout the studio. This unit picked out noises traceable to eddy currents and air turbulence in the neighborhood of 1,000 to 1,200 cycles per second, and traced them down to individual diffusers. Standard studio microphones mounted on studio booms were also used. These microphones, previously described, are connected through the studio sound system to the broadcast console in a control room. As the microphones were swung about the studio, particularly near diffusers, they picked up low frequency rumbles coming from the diffusers of about 100 cycles per second.

Noise from Turbulence

It was found that most of this noise, both from the diffusers themselves and that caused by air turbulence or eddy currents in the studio, could be eliminated by adjusting one or more of the four slots in the diffusers. A sliding plate in each of the diffuser outlet slots permitted a fine adjustment of air delivery to remove noise caused by air movement from the diffusers and air movement about the studio. The sound level from the diffusers themselves was reduced almost to zero as far as registering the noise on the studio microphones was concerned.

Control Rooms

The three control rooms, previously described, are completely air conditioned. These rooms are located at the south end of the main studio, and overlook this room at the second floor level.

An 8,000 cfm air handling unit, equipped and controlled similarly to the larger air handling unit that supplies the studios, sends conditioned air to the control rooms. This air handling unit has three zones, and permits individual control of temperature in each—supplying cooling to one and heat to the others, if necessary. One zone handles the three control rooms, the other two handle offices and dressing rooms and also a viewing corridor.

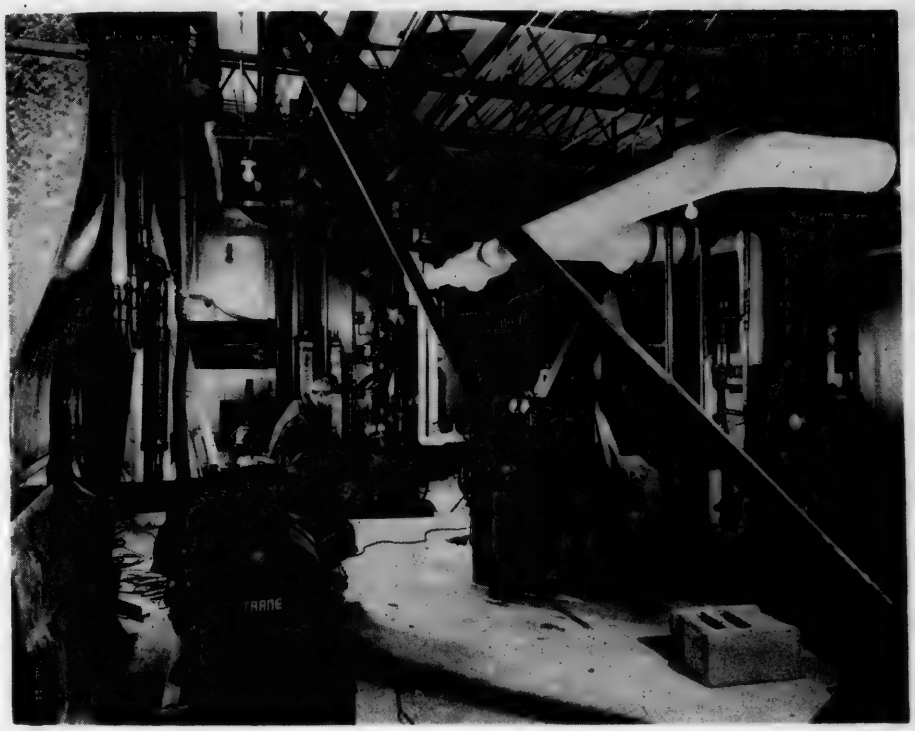


Fig. 7. View of machinery room adjacent to main studio. In the foreground can be seen legs of the television transmitting tower.

The main video control room posed a real problem. This room is occupied by the program director and the technical director who direct camera switching and control special effects.

In the close quarters of this small room is a sensible load of 66,270 Btu, of which 25,500 Btu are from one entire east wall of banks of electronic tubes, plus a number of monitoring TV sets. The latent load of this room is 31,450 Btu including outside air dehumidifying. All air delivered to the control room is exhausted to the atmosphere after first passing through the banks of tubes on the east wall.

It was necessary to keep noise from the air conditioning system at a minimum because the directors' work requires absolute concentration. Air is delivered through a special plenum which runs the entire length of the room. Five 36 x 4-inch registers direct the tempered air over the room and 30 air changes per hour are provided in this control space.

Rooms for Directors

The two smaller control rooms are air conditioned in a similar manner. Ordinarily the video and studio control equipment and personnel are together in one room. Studio officials decided, on the basis of previous experience, that it was best to separate these functions. While the program director must listen over headphones to his crew on the studio floor, the audio control operator often had to turn up the volume on his system to pick out sounds or to listen closely to low volume whispering of performers. Often the audio director turned up his volume loud enough to make it difficult for the program directors to hear responses from the floor crew in their headphones.

With separate control rooms, soundproofed from each other, the audio man can turn up the volume as necessary, without disturbing the video directors. Control room walls are lined with acoustical, sound absorbing material.

The remaining control room is occupied by an announcer whose voice is heard but who himself is not seen. His is the voice that accompanies slides or films and which gives the commercials "live" (as compared with "canned" or recorded commercials) along with this visual material.

In some cases, intense dramatic action can take place on the television set during absolute silence. In this case the video control director can turn off the air conditioning completely during the few moments of this period to eliminate even the minute amount of noise from the system that would ordinarily be well under "program zero."

Summary

Air conditioning system design requirements for television studios used for live producton of telecasts in both black and white and color must meet demanding specifications of low noise, low air movement and accurate control of temperature at all times. As licensing and construction of facilities in major cities increase, it is expected that these problems will find relatively standardized solutions to facilitate system design. Close cooperation between the consulting engineer, architect and contractor is vital to insure adequate and proper sound insulation both structurally in the building and in the various components of the system. It is also highly advisable to work in very close conjunction with the studio's chief engineer as design work proceeds.

The year-round air conditioning system for the station described was designed by G. M. Orr Engineering Company; the architect was Loren B. Abbett; equipment was installed by Northern Air Conditioning Company, all of Minneapolis, Minn.

The Valve Flow Coefficient, C_v

and Its Contribution in Control Valve Sizing

RALPH A. ROCKWELL

Valve Division, Minneapolis-Honeywell Regulator Co.

Sizing of a flow control valve is premised on a full knowledge and weighed evaluation of flow data. Most sizing procedures make use of the valve flow coefficient, C_v, which materially simplifies the problem. The use of C_v provides a simple method applicable to a wide variety of valve constructions, valve sizes, and flow conditions.

SIZING methods for flow control valves are reasonably exact, and most errors in sizing can be traced to unreliable flow data or incorrectly assumed operating conditions. The tendency is to set an arbitrary minimum pressure drop and to add too many safety factors to the flowing quantity which results in a valve size many times too large.

When the control valve is to be installed in a long piping system, it is necessary to calculate the pressure drop in the system to determine the available drop remaining for the control valve. *Operating conditions should be checked if the drop across the valve is less than 30% of the drop across the piping system (exclusive of valve).* This general rule may be impractical and by necessity be relaxed for extremely high pressure drop systems. The amount of pressure drop required for good control is a function of the pressure drop across the valve with respect to the pressure drop across the rest of the piping system. This ratio should be increased if the flow range is wide and may be reduced when variations in flow are small. If the drop across the valve is only a small percentage of the total system drop, the valve rapidly loses its ability to further increase the flow. Hence, a control valve generally figures out smaller than line size.

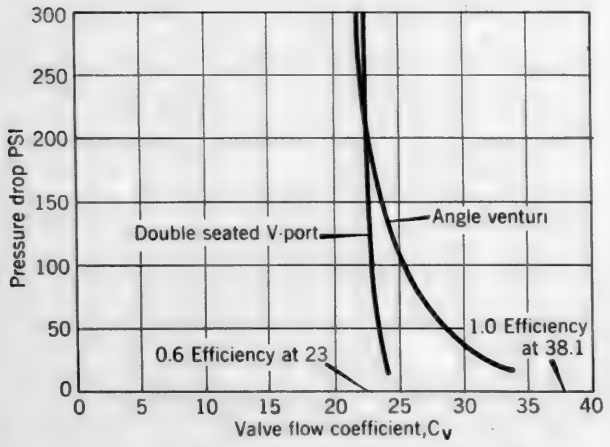


Fig. 1. Behavior of C_v with respect to pressure drop for two different valves handling water. Port area is 1 sq inch. Body restriction is negligible.

When a control valve size is the same as the line size, the calculations for both the line size and the valve size should be reviewed.

The maximum flowing quantity used in determining the valve size should be 25 to 60% above the process maximum. This increase in quantity above the process maximum is a safety factor to insure that the valve is not required to control flow at or close to the full open position. The valve flow range should always be in excess of the process flow range and thus provide safety factors both above and below the normal process requirements. After the C_v and valve size have been determined, it is frequently desirable to review the operating data as a guide to final size selection.

In this discussion of pressure drop and flowing quantity, two general rules have been offered for guidance in valve sizing. In a later section, a graphical presentation is given showing the application of the rules in a typical sizing problem.

Definition

The valve flow coefficient C_v is the standard measure of valve flow capacity. By definition the valve flow coefficient is the number of U. S. gallons of water per minute that will flow through the valve in a wide open position with a pressure drop of 1 psi. The C_v rating is determined by flow tests with the pressure drop measured at the inlet and outlet piping adjacent to the valve body. Therefore, the capacity rating is an over-all rating including both the maximum port area and the body passages. The C_v is based on the fundamental law of fluid flow ($V = \sqrt{2gh}$) and is not restricted to any specific type of valve or any specific fluid.

The formula, $V = \sqrt{2gh}$, expresses the ideal velocity of fluid in a pipeline and may be used to develop the ideal C_v of a given port area in a valve. Comparing the ideal C_v to the actual C_v points up the discrepancies from the ideal and provides a convenient basis for analysis.

In the expression, $V = \sqrt{2gh}$, V equals velocity in feet per second, g is the gravitational constant of acceleration (32.2 ft per sec^2), and h is the head of the flowing fluid in feet. In valve sizing problems, we are interested in the flowing quantity, such as gpm, which can be ob-

tained by multiplying the velocity times the area. The conventional units used in defining C_v are gallons per minute, pounds per square inch and specific gravity where water equals 1.0.

The ideal or theoretical C_v for a valve or any other flow restriction with a port or orifice area of 1 square inch may be expressed as follows:

$$\text{Velocity} = \sqrt{2gh}$$

$$\text{Flow} = \sqrt{2gh} \times \text{area}$$

$$C_v \text{ for 1 square inch} = \frac{60\sqrt{2\times32.2\times2.308}\times12\times1}{231}$$

$$= 38.1 \text{ (ideal)}$$

Where

area = 1 square inch

$\triangle P$ = 1 psi pressure drop (head)

Q = flow water gpm

Therefore, according to the law of fluid flow, a valve port or an orifice with an area of 1 square inch will pass 38.1 gallons of water when a pressure drop of 1 psi exists across the opening and certain restrictive influences are neglected.

The flow of fluid is an empirical science and the ideal formulas or expressions seldom represent the actual conditions. In practice most flow expressions include a factor or a constant to correct the theoretical to the actual. The C_v of 38.1 for a 1 square inch area port is an ideal figure and disregards the jet contraction, the velocity of approach, the velocity distribution effect, and friction. These are the factors neglected in the simplified theory from which this ideal C_v rating was developed. When we test to determine the actual C_v of a 1 square inch area port or orifice, we find the C_v rating to be approximately 23. The efficiency of any flow restriction is the ratio of the actual over the ideal in this case or 0.6. In a control valve this efficiency can only be obtained when the body restriction is negligible.

The trend in the control valve industry during the past 15 years has been towards larger and larger C_v ratings. In conventional body designs very little can be done to materially reduce the over-all body flow restriction. Internal passages are normally expanded well above line size but the inlet and outlet connections must conform to line size. To achieve the present C_v ratings, the port area of the valve must be increased to compensate for the body resistance. The average increase in port area to compensate for normal body losses is in the neighborhood of 25 to 30% and the apparent port efficiency when the pressure drop is measured in the adjacent piping drops off to 0.4 to 0.5 (C_v = 15 to 19).

Where we have referred to a C_v as an exact number, it still must be considered an approximation in view of the fact that the valve industry has not standardized on any exact testing procedures. Differential pressures are measured in the adjacent piping, and variations in the location of the pressure taps with respect to the body of the valve, as well as the line size in which the valve is installed, can appreciably alter any exact C_v determination. With a 50:1 equal-percentage valve, an error of 1% in positioning the plug at rated lift (0.010 inches for 1-inch lift) will result in a C_v error of 4%. This same magnitude of error could exist due to variations in machining the plug seats with respect to the position of the ports.

Fig. 1 graphically illustrates C_v behavior with respect to pressure drop for two different types of valve. Both curves have been extrapolated from test data to permit the use of a port area of 1 square inch for purposes of comparison with the ideal C_v of 38.1 and its efficiency of 1.0. The curves are included to show typical behavior and do not necessarily represent precise test data.

Note that the double-seated valve has a C_v of 24 at 10 psi drop. The C_v decreases to 23 at 100 psi drop and falls slightly below 23 at 300 psi drop. The C_v adheres to the square root law remarkably well for drops up to 400 psi. We have not tested this type of valve at pressures in excess of 400 psi, and field observations are too rough to permit us to predict the behavior into the higher pressure drops. This, essentially, is a so-called low efficiency valve but the efficiency is maintained over a wide range of pressure drops.

This behavior is reassuring to those who question the application of the square root law. Hydraulic data are empirical and the literature does not provide any data on which to estimate the C_v behavior at pressure drops of 2000 or 3000 psi.

The variation in C_v of the angle valve is a special case and can be accounted for by pressure recovery in the valve outlet, bearing in mind that the differential pressures are measured in the adjacent piping. High pressure recovery in one of the more important characteristics of a venturi throat used for flow measurement. In measure-

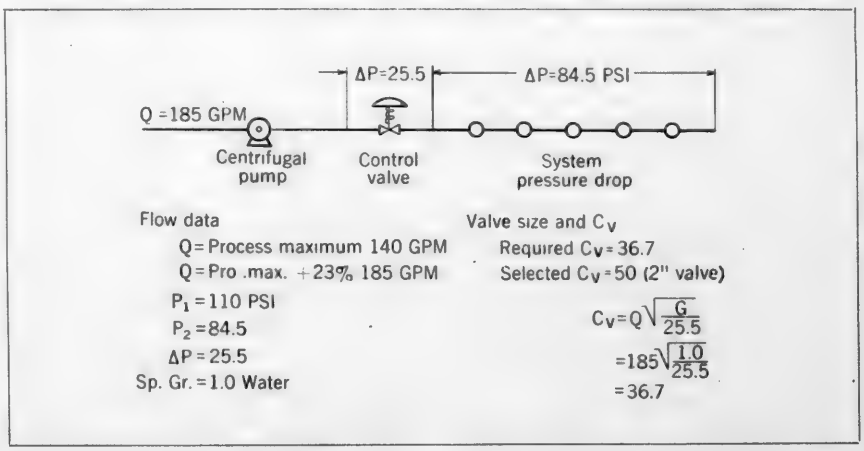


Fig. 2. Example of control valve and process piping system.

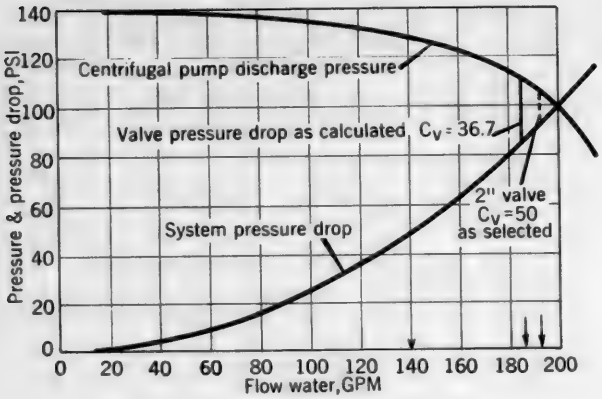


Fig. 3. Plot of conditions shown in Fig. 2.

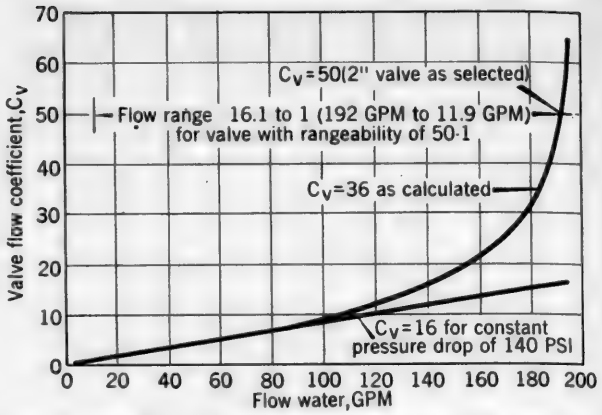

C_V = 50 (2" valve as selected)
Flow range 16.1 to 1 (192 GPM to 11.9 GPM)
for valve with rangeability of 50-1
C_V = 36 as calculated
C_V = 16 for constant
pressure drop of 140 PSI
Valve flow coefficient, C_V
Flow water, GPM

Fig. 4. Plot of C_v required by example system in flow range from 0 to 200 gpm.

ment the venturi throat seldom has a pressure drop in excess of 100 inches w.g. (4 psi) which is the range where the venturi type of valve also shows a substantial amount of pressure recovery. As the velocity and pressure drop increases, the pressure recovery diminishes and the curve of the angle valve shows this typical behavior.

The angle valve has been identified as a high efficiency type valve. Note that at 3 or 4 psi drop it has a C_v capacity rating approaching 38.1 with an efficiency of 1.0. However, with increased pressure drop the C_v rating falls off rapidly. At 50 psi drop it's 28.5 and at 200 psi it has dropped to 23. The venturi valve or the angle-venturi type valve is largely classed as a high pressure valve and most manufacturers have established a C_v rating at the high pressure drop. There is no practical reason why any allowance should be made in valve sizing for the higher capacity which is only available in the low pressure drop range.

Example

The example in Fig. 2, 3 and 4 shows the application of the two generalized sizing rules for flow and pressure drop.

(1) Sizing flow should be 25-60% over process maximum.

(2) Pressure drop across the valve should be at least 30% of the system drop.

The valve and process piping system is shown in Fig. 2 with flows, pressure drop and valve selection tabulated. This example has not been included for the purpose of justifying or substantiating the rules, but rather to present an analysis and to provide a background whereby the rules may be intelligently disregarded.

In Fig. 3 this system is shown graphically; plotting pressures and pressure drops against flow up to the system maximum flow of 200 gpm. The pump discharge pressure curve intersects the system drop at 200 gpm. This is the maximum flow of the system whereby the full head of the pump is dissipated in pressure drop in the piping and miscellaneous process equipment. It is assumed that the control valve has been replaced with an oversized spool piece which would have negligible drop.

The vertical distance between the two curves indicates the pressure drop which the valve must absorb in order to control the flow in the range between 0 and 200 gpm. At any given value of flow, the full head of the pump must be absorbed by the sum of the pressure drop across the valve and the system.

The valve size as calculated requires a C_v of 36.7 in order to obtain a flow in the wide-open position of 185 gpm. This necessitates a 2-inch valve with a C_v of 50 giving a maximum flow of 192 gpm at a pressure drop of 14.2 psi.

Fig. 4 is a graph plotted for this same system showing the required C_v or valve capacity for the flow range of 0-200 gpm. Note that the curve is approaching 200 gpm asymptotically and, therefore, a valve for that flow rate would have to be infinitely large. Under the conditions of varying drop, a valve with a rangeability of 50:1 would have a system flow range of 16.1 to 1 or a turndown ratio (from 185 gpm) of 15.6 to 1.

With a constant pressure drop across the valve, a C_v of 16 would be adequate to pass a flow of 192 gpm. The rangeability and the flow range would be identical and a 50:1 valve would give a flow range of 50:1 or 192 to 3.8 gpm.

Summation

While sizing formulas are based on the assumption that the flow varies as the square root of the pressure drop, there is some question as to the validity of the application of the square root law to such a complex restriction as a control valve, especially under extreme operating conditions. Except in unusual circumstances, the error resulting from the use of the square root law is seldom of sufficient magnitude to justify complicating the sizing procedure by corrections which, in many instances, may be extremely difficult to correlate to the case at hand.

The formulas for steam and gases include a density correction which is a function of the outlet pressure psi (P_2). This is an assumption which is not strictly true, as the exact correction should be some intermediate value between the inlet and outlet pressures. The use of the outlet pressure is a conservative simplification, tending to underrate the valve capacity up to approximately 15% at the critical pressure ratio. Although the use of the outlet pressure P_2 in the compressible flow formulas which follow may somewhat underrate the valve capacity, there is, as yet, no general agreement of test procedures, nor

sufficient data by independent investigators to generalize on the extent of the actual deviation.

It should be recognized that present valve sizing procedures are based on assumptions that are not strictly valid and on theory which in many instances is inadequate. However, without the use of simplified theory and reasonable assumptions, the practical problem of sizing becomes hopelessly complicated. Although it is based on experimental data and corrected for body losses and efficiency of the port and passages, the experimental determination of the valve C_v does not take into account the variations of the characteristics of the fluid in question; the changes in the state of the fluid or the wide variations of pressure drop and velocity which may exist in various installations. It is in this region that the rule of thumb, based on experience and rational assumptions, is necessary. Improved techniques and more exact determinations of the behavior of fluids under various conditions may improve the theoretical accuracy, but the overall accuracy will still be limited somewhat by the difficulty of evaluating operating conditions.

Sizing Procedure

To determine valve size,

Given: All flowing conditions.

Solve: For C_v and select valve size for the type of valve under consideration from Manufacturer's Table of C_v rating vs valve size.

To determine valve capacity,

Given: C_v and flowing conditions.

Solve: For capacity V in U. S. gpm of liquid
Q in cfh gas at 14.7 psia and 60F.
W in pounds of steam per hour.

For liquid

$$C_v = V \sqrt{\frac{G}{\triangle P}} \qquad (1)$$

$$V = C_v \sqrt{\frac{\triangle P}{G}} \qquad (2)$$

where
V = flow, gpm (U. S.)
$\triangle P$ = pressure drop at maximum flow, psi
G = specific gravity (water 1.0)
C_v = valve flow coefficient

When flowing temperature is above 200F, use specific gravity and quantity at flowing condition.

For gas

$$C_v = \frac{Q \sqrt{G\ T_a}}{1360 \sqrt{(\triangle P)\ P_2}} \qquad (3)$$

$$Q = \frac{1360\ C_v \sqrt{(\triangle P)\ P_2}}{\sqrt{G\ T_a}} \qquad (4)$$

where
Q = cu ft per hr at 14.7 psia and 60F
$\triangle P$ = pressure drop at maximum flow, psi $(P_1 - P_2)$
P_1 = inlet pressure at maximum flow, psia
P_2 = outlet pressure at maximum flow, psia
G = specific gravity (air = 1.0)
T_a = flowing temperature, absolute (460+ F)
C_v = valve flow coefficient

When P_2 is less than $\frac{1}{2}\ P_1$, use the value of $P_1/2$ in place of $\sqrt{(\triangle P)\ P_2}$

For steam

$$C_v = \frac{W K}{3 \sqrt{(\triangle P)\ P_2}} \qquad (5)$$

$$W = \frac{3\ C_v \sqrt{(\triangle P)\ P_2}}{K} \qquad (6)$$

where
W = pounds of steam per hour
$\triangle P$ = pressure drop at maximum flow, psi
P_1 = inlet pressure at maximum flow, psia
P_2 = outlet pressure at maximum flow, psia
K = 1 + (0.0007 × F superheat)
C_v = valve flow coefficient

When P_2 is less than $\frac{1}{2}\ P_1$, use the value of $P_1/2$ in place of $\sqrt{(\triangle P)\ P_2}$

The steam formula has been set up using $\frac{1}{0.00225\ P_2}$ in place of the specific volume, to eliminate the need for steam tables.

Note: The flow of compressible fluids through a restriction reaches a saturation velocity when the differential pressure is increased to approximately 50% of the inlet pressure. This critical pressure ratio varies with the composition of the fluid. The average value of one-half the absolute inlet pressure is well within the tolerance established by the formulas.

For vapors other than steam (general formula-weight basis)

$$C_v = \frac{W}{63.4} \sqrt{\frac{v_2}{(\triangle P)}} \qquad (7)$$

$$W = 63.4\ C_v \sqrt{\frac{(\triangle P)}{v_2}} \qquad (8)$$

where
W = pounds of vapor per hour
$\triangle P$ = pressure drop at maximum flow, psi $(P_1 - P_2)$
v_2 = specific volume (cu ft lb at outlet pressure P_2
P_1 = inlet pressure at maximum flow, psia
P_2 = outlet pressure at maximum flow, psia
C_v = valve flow coefficient

When P_2 is less than $\frac{1}{2}\ P_1$, use the value of $P_1/2$ in place of $(\triangle P)$ and use P_2 corresponding to $P_1/2$.

Rays from the sun are collected by a 10-ft aluminum mirror and reflected to a dime-size focal point in Convair's solar furnace. When sky conditions are ideal, the furnace can develop a temperature of 8500F.

SOLAR FURNACE

DEVELOPS 8500 F

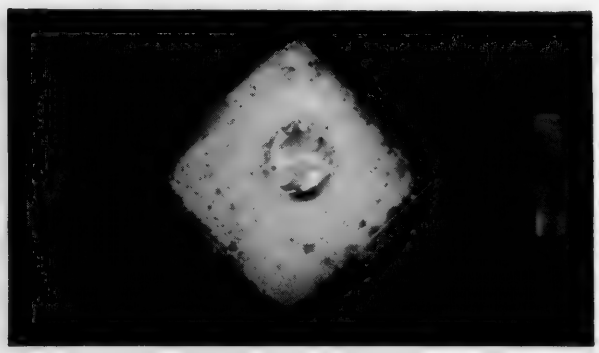
THE largest solar furnace in this country is now being used by Convair's San Diego division to study various metals and ceramic materials in connection with several research projects. Originally designed by Dr. Willi M. Conn, the furnace was used at Rockhurst College before Convair acquired it recently.

The basic part of the instrument is a 120-inch diameter polished aluminum mirror formed into a parabolic reflector. Made of ¼-inch aluminum, the reflector draws its power from a 10,000F heat source—the sun's surface. Rays from the sun are collected by the huge mirror and reflected to a focal point, forming a 5/16-inch diameter image of the sun at a distance of 34 inches from the center of the mirror. Materials being tested are held by metal jaws at this dime-size focal point.

The intense heat at the focal point melts a steel bolt in a matter of seconds. When sky conditions are ideal, the furnace can develop a temperature of 8,500F. The temperature produced by an oxyacetylene torch, by comparison, is around 5800F.

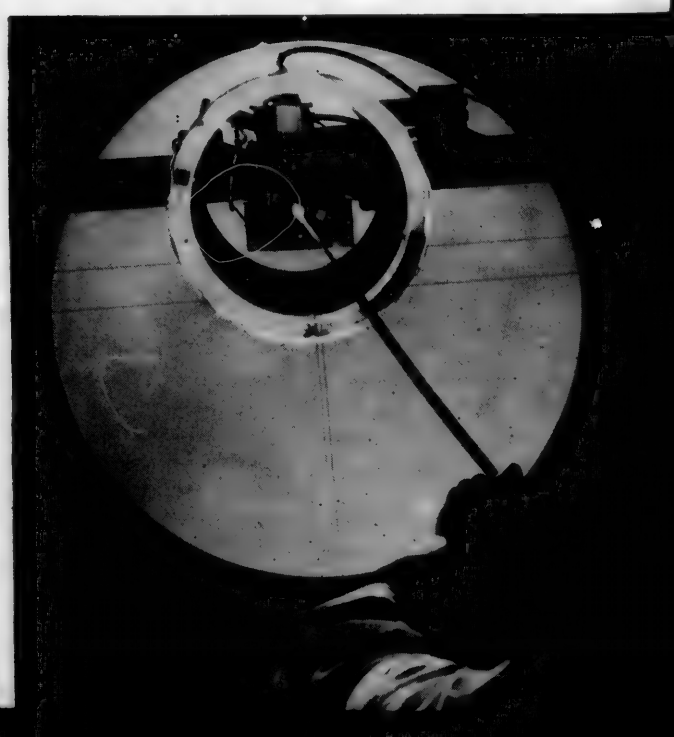
F. W. Fink, chief engineer, Convair's San Diego division, said Convair has found several advantages in using the solar furnace for research projects. Heating is accomplished under very pure conditions and in an oxidizing atmosphere. There is no interference from electric or magnetic fields or gases which often occurs when other types of furnaces are used.

A bridge structure spanning the mirror a short distance beyond the focal spot supports the specimen holder. After part of the sample melts, adjacent regions are moved into the focal spot by means of a motor-driven screw. The bridge also supports a cylindrical barrel about 18 inches in diameter. This is used to shade a part of the mirror from the specimen so that the amount of solar radiation concentrated on the specimen can be controlled.



A ceramic specimen begins to melt at the focal spot.

(Below) A steel rod in Convair's solar furnace becomes white hot in seconds as the end is held at the focal point. Metal cylinder can be moved down to shade the specimen, permitting control of heat.



(Below) Principle of solar furnace is illustrated as smoker lights up by using a flashlight reflector.

Heat-Loss Graph for Specifying Block Insulation Thickness

DETERMINING the thickness of thermal insulation which should be applied on heated industrial equipment can be either a standardized selection or an individual design procedure. Standard thicknesses for various operating temperatures may be adopted for company-wide use, avoiding the need for reconsideration of specifications on each new job. On the other hand, the cost of insulating materials and installation may be weighed against the cost of heat loss to obtain the most economical insulation thickness under expected operating conditions and equipment life. The designer usually finds standard thickness (such as in Table 1) are satisfactory when the cost of heat in a new installation is about equal to that on which previous jobs have been based. However, when the cost of heat is unusually high or low or when a job is particularly large, a closer investigation of the most economical insulation thickness is certainly justified by the resulting savings in fuel dollars.

The heat-loss graph has been designed to help the engineer and specifier in determining the most economical thickness of mineral wool block or board insulation in specific cases, without requiring repeated calculations.

TABLE 1.—RECOMMENDED MINIMUM THICKNESS OF MINERAL WOOL BLOCK OR BOARD INSULATION

Temperature, F	Thickness, Inches
up to 200	1
200-400	1½
400-500	2
500-600	2½
600-700	3
700-900	3½
900-1100	4
1100-1300	4½
1300-1500	5
1500-1600	5½

Hot-surface temperature and fuel cost per million Btu are fixed by the application, while the required data on materials and installation costs are obtained from insulation contractors or manufacturers.

To use the graph, start at hot-surface temperature on the scale at the lower left and proceed vertically to the given block or board insulation thickness on the curves at left. A horizontal line through this point intersects the vertical scale in the center at both heat loss per hour in

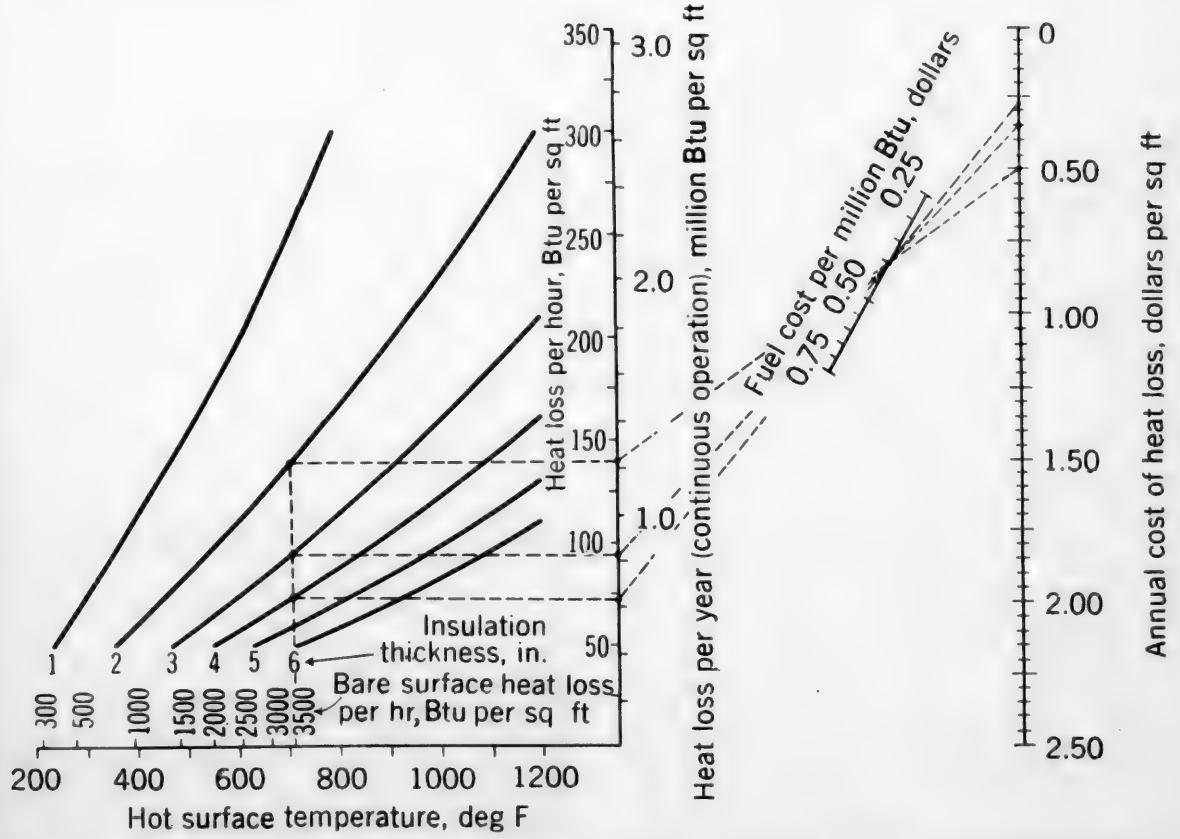


Fig. 1. Cost of heat loss to 80F ambient still air from bare and insulated surfaces using mineral wool block insulation.

TABLE 2.—EXAMPLE COST DATA

Insulation Thickness, Inches	Annual Cost of Heat Loss from Graph, $ per sq ft	Annual Heat Savings Over 2-Inch Thickness, $ per sq ft	Added Material and Installation Cost (Approx.) Compared to 2-Inch Thickness $ per sq ft
2	0.50	....	....
3	0.35	0.15	0.26
4	0.27	0.23	0.54

Btu per sq ft and heat loss per year in million Btu per sq ft for continuous operation (annual heat loss may be adjusted proportionately when operation is not continuous). Follow with a line through heat loss on the center scale and through cost per million Btu on the slanted scale to meet the righthand scale at the approximate annual cost of heat loss in dollars per sq ft.

Assume an engineer wants to determine the most economical thickness of mineral wool block insulation for an industrial oven operating continuously at 710F and at a fuel cost of 40 cents per million Btu. By applying the graph (as shown by the dotted lines) he obtains and tabulates the heat-loss costs for tentative insulation thicknesses of 2, 3, and 4 inches, which are tabulated in the second column of Table 2. He then tabulates the added cost (materials and labor) to provide 3 inches or 4 inches as compared to 2 inches. In Table 2, it is assumed that 3-inch insulation costs 26 cents more per square foot when installed than 2-inch mineral wool blocks; 4-inch costs 54 cents more per square foot than 2-inch.

It is evident that 3 inches is a more economical thickness than 2 inches, if the oven will be in use 2 years or longer. A thickness increase to 4 inches saves 23 cents per sq ft each year but costs 54 cents more to install initially than 2 inches. The added 2 inches of insulation (4 inches versus 2 inches) would take less than 3 years to pay for itself at the assumed fuel cost of 40 cents per million Btu. Thus, selection of insulation thickness would be governed by the anticipated operating life of the oven.

From the bare-surface heat loss scale at the lower left of the graph, it is noted that the bare loss at 710F is about 3500 Btu per (sq ft) (hr) at 80F ambient. At the same fuel cost, the annual cost of heat loss (without insulation) would be about $22 per sq ft.

It may be necessary to consider factors other than material and installation costs in determining economic insulation thickness. However, the costs of materials and installation are almost always far more important.

Assumptions in Graph

Heat loss in plotting the graph is given by the expression

$$U = \frac{t - 80}{\frac{x}{k} + \frac{1}{c}} \qquad (1)$$

where U = overall rate of heat loss, Btu per (hr) (sq ft); t = hot-surface temperature, F; 80 = assumed constant ambient temperature, F; x = insulation thickness, inch; k = thermal conductivity of insulation, Btu per (hr) (sq ft) (deg F per inch); c = surface conductance factor assumed constant at a typical value of 2.

Thermal conductivity is given by

$$k = .32 + .00025t \qquad (2)$$

representing typical design values for mineral wool block or board insulation for heated applications. Temperature of the outside insulation surface is assumed constant at 120F in converting mean temperature to hot-surface temperature, t in equation (2).

Because of the several assumptions made, the graph cannot be expected to be more accurate than $\pm$ 15% although most results (with reasonable thicknesses of insulation) will be quite close to actual values. When the graph is used on a comparative basis, of course, greater accuracy may be expected.

Dehumidifier Aids Handling of Business Machine

Besides greatly improving personal comfort, its primary objective, the air conditioning system installed in the executive office building of the Kellogg Company's main plant at Battle Creek has eliminated the curling and stretching of punched cards used in their automatic tabulating equipment.

This trouble resulted from the tendency of paper and cards to absorb moisture from damp air, causing them to warp so that it was difficult to run them through the machines.

Realizing the important element of humidity, the air conditioning system installed at Kellogg features such control. Two Kathabar Units, manufactured by Surface Combustion Corporation, combined with after heating and cooling coils automatically maintain inside conditions at 78F and 45% relative humidity regardless of the outside variations in humidity and temperature.

EXHAUST FOR HOT PROCESSES

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Design considerations for both canopy hoods and exhausted enclosures for hot processes differ markedly from those associated with ordinary exhaust situations. Convection currents and thermal head are two of the influences analyzed here. This Reference Section is based on a chapter in the author's forthcoming book, Plant and Process Ventilation, soon to be published by The Industrial Press.

THE TERM canopy hood in the present treatment includes any suction opening that is located above a source of contamination, regardless of its shape or height above the source it is intended to service. It may take the form of a large positive-flow roof ventilator directly above a large scale heat process; a suction grille in a ceiling above a hot, fuming process; or a low-hanging pyramid-shaped hood above a tank.

A low-hanging canopy hood above a *cold* process is essentially the same as a *booth*, having four open faces instead of a single-plane opening. Design of such a booth is based on development of a design face velocity by forced induction of a calculated amount of the surrounding room air. In a great many cases, however, the canopy hood is really intended to function as a *receiving hood* for hot gases, fumes, or smoke, and design of such a hood, beyond the specification of shape, dimensions, and position, consists principally in a sound analysis of the rate, q_s, at which contaminated hot air is *delivered* to the face. The receiving hood is disposed at a point along the axis of delivery, and the exhaust rate is properly specified to be at least equal to the delivery rate. Therefore, velocity contours, which must be considered in design of suction hoods for cold processes, *have no place in the design of receiving hoods.* The basic difference is illustrated in Fig. 1.

Canopy hood installations frequently have a common failing. If the contaminant be a visible dust or fume, hot air can be seen curling outward under the rim of the hood to escape into the general room air, exactly analogous to the way water would overflow the rim of a vessel if the supply rate exceeds the rate of withdrawal (Fig. 2). The cause of such air escape is identical with that in the water

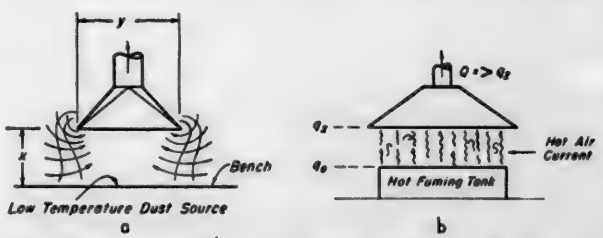

Fig. 1. (a) Velocity contours around hood over cold process are considered in setting exhaust rate to induce design velocity through face area 4xy. (b) Hood over hot process is a receiver, and exhaust rate is based on the amount delivered to the canopy itself.

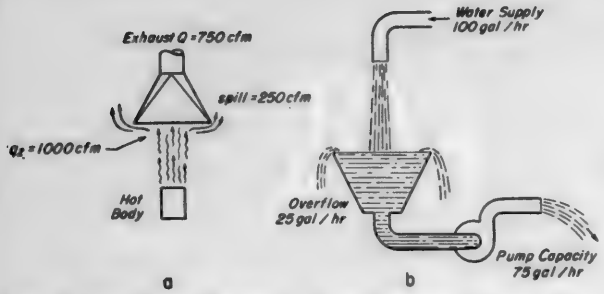

Fig. 2. When exhaust rate, Q, is less than the delivery rate, q_s, spillage at the rim in (a) is exactly analagous to the water system in (b) wi ere water supply rate exceeds pump capacity.

tank—hot air is being delivered to the hood, at a greater rate than the rate of exhaust.

Air Flow from Hot Bodies

The mechanism of convectional heat loss includes molecular conduction through a thin film at the hot surface to the adjacent air which when warmed becomes lighter than surrounding air and is forced to rise, its place being taken by cooler air in the vicinity. The rate of air flow resulting is related to the rate of convectional heat loss.

The velocity with which a mass of warm air rises is determined by the force of gravity, and its magnitude is expressible in terms of the falling body formula, $v = \sqrt{2gh}$. Where the velocity of a rigid body moving through air is affected by the frictional air resistance, the motion of a mobile mass of air is influenced by the relative turbulence since that determines the rate of mixing and dilution with the surrounding air.

Consider the buoyant air currents flanking hot surfaces, for example a heated vertical panel (Fig. 3). If the specific gravity of the general mass of cooler air surrounding the rising column be called unity, and that of the hot air, s_h, the net buoyant head responsible for velocity is

$$h = (1 - s_h)m$$

where m is the height of the column. The value for s_h due to temperature can be expressed in terms of absolute temperatures

$$s_h = \frac{T_c}{T_h}$$

where subscripts $_c$ and $_h$ refer to cooler and hotter air masses. The formula $v_h = \sqrt{2gh}$ then becomes, after converting v_h(fps) to V_h(fpm) and giving g its numerical value, 32.2.

$$V_h = 480\sqrt{m\,\frac{(T_h - T_c)}{T_h}} \qquad (1)$$

This can readily be transformed to an expression for air flow rate, q, by multiplying it by the cross-sectional area of the rising stream. However, the appearance of T_h in the formula raises difficulties in its application to practical problems. Mixing occurs throughout the travel of the column, hence the column temperature varies in proportion to the quantity of cooler air entrained. It is therefore desirable to proceed to elimination of the temperature difference term if possible.

The ordinary heat capacity formula applies to the same air stream, and may be written:

$$t_2 - t_c = T_2 - T_c = \frac{H'}{\rho_h(q_0)(0.24)} \qquad (2)$$

where t_2 and T_2 are Fahrenheit and absolute temperatures at top of hot air column; H' is sensible heat transfer from process to air stream in Btu per minute; ρ_h is density of heated air; q_o is cfm of air in motion at top of heat source.

$$T_h - T_c = \left(\frac{q_0}{480A_p}\right)^2 \frac{T_h}{m} \qquad (3)$$

where A_p is projected area of the object or of the hot air stream.

If equations (2) and (3) could be set equal to each other a useful equation for q_o would result; the validity of this procedure hinges on the difference between T_2 and T_h. The term T_2 represents the final air temperature of the leaving air stream corresponding to the complete absorption of the heat, H', whereas T_h is the average temperature in the column (because related directly to m). The error in assuming equivalence of T_h and T_2 may not be serious for our purposes.

Combination of equations (2) and (3) gives:

$$q_0^3 = \frac{10^6 H' A_p^2 m}{T_h \rho_h} \qquad (4)$$

which is further simplified by calling $\rho_h = 0.075\,\frac{T_c}{T_h}$, where

$$T_c = 460 + 70 = 530$$

$$q_0^3 = 2.5 \times 10^4 H' A_p^2 m \qquad (5)$$

$$q_0 = 29\sqrt[3]{H' A_p^2 m} \qquad (5a)$$

q_o = air induction rate at upper limits of hot body, cfm

Stream Area. Area of the hot air stream cross-section may often be approximated from the dimensions of the hot body. For example, in the case of horizontal rods,

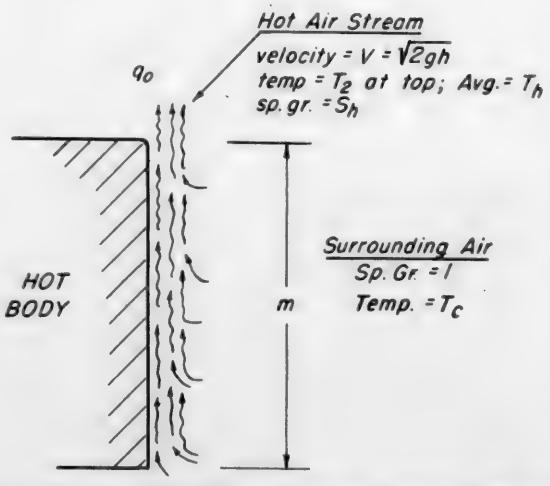

Fig. 3. Induction of air flow by transfer of sensible heat from a hot vertical surface to surrounding air.

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the width of the stream is very close to the diameter of the rod.

The air stream beside a vertical plane appears to thicken at an agle of 4 to 5 degrees with the plane and this will serve for estimation of stream areas in this category.

The effective stream area for horizontal planes is uncertain. It is suggested that it be taken to be equal to, or somewhat less, than the area of the plane itself.

Heat Loss—H′. Heat loss, H', is readily estimated from well-established formulas. Note that total heat loss includes radiation losses which do not concern one in this application. Convectional heat loss formulas for all shapes are similar in form, and do not vary greatly in absolute values. The h_c coefficients summarized in Table 1 are for use in the formula:

$$H' = \frac{h_c A_s (\Delta t)}{60}$$

where h_c is the convection coefficient; A_s is the surface area *emitting heat*, which is not to be confused with area of stream cross-section, A_p; $\triangle t$ is temperature difference between hot skin temperature and room air temperature; H', as before, is Btu per min. The prime exponent has been used to remind the reader that it is the minute rate, whereas heat losses are conventionally calculated on an hourly basis. Heat loss rates are further summarized in Fig. 4.

Values for m. In the case of vertical planes, m is obviously the height of the plane itself. For horizontal cylinders it is the diameter. It is not immediately obvious what the dimension of m for horizontal planes should be.

Comparison of the coefficients for large vertical and horizontal plates shows that heat transfer is greater only by about 25% for horizontal planes which, together with the relation between V and m shown in equation (1). suggests that the dimension for m may be the same as though it were disposed vertically, i.e., the horizontal diameter. The uncertainty regarding the proper value for stream area, referred to above, is considerably greater, and indeed of more importance because q is proportional to the two-thirds power of area and only to the cube root of m. There is need for experimental investigation on these points.

The preceding discussion is concerned with the magnitude of air flow, q_o, at the upper boundary of a hot body. The flow rate, q_z, at the hood level, after mixing and dilution has occurred, is discussed later (see "High Canopy Hoods").

TABLE 1. COEFFICIENTS FOR CALCULATING SENSIBLE HEAT LOSS BY NATURAL CONVECTION

Shape or disposition of heat surface	Natural convection heat loss coefficient, h_c
Vertical plates, over 2 ft high	$0.3(\Delta t)^{1/4}$
Vertical plates, less than 2 ft high (X = height in ft)	$0.28\left(\frac{\Delta t}{X}\right)^{1/4}$
Horizontal plates, facing upward	$0.38(\Delta t)^{1/4}$
Horizontal plates, facing downward	$0.2(\Delta t)^{1/4}$
Single horizontal cylinders (where X' is diameter in inches)	$0.42\left(\frac{\Delta t}{X'}\right)^{1/4}$
Vertical cylinders, over 2 ft high (same as horizontal)	$0.4\left(\frac{\Delta t}{X'}\right)^{1/4}$

Vertical cylinders less than 2 ft high. multiply h_c from formula above by appropriate factor below:

Height	*Factor*
0 1 foot	3.5
0 2	2.5
0 3	2.0
0 4	1.7
0 5	1.5
1 0	1 1

Heat loss coefficient, h_c, is related to H', as follows:

$$H' = \frac{h_c}{60} A_s \Delta t$$

Low Canopy Hoods

One category of canopy hood includes those that are mounted above horizontal hot surfaces with vertical distances not much greater than three feet. Some simplified relationships can be derived on the basis of the assumptions indicated in the following. Considering the rising air column to be about the area of the horizontal heated surface below, it can reasonably be inferred that little mixing with room air occurs during its short vertical

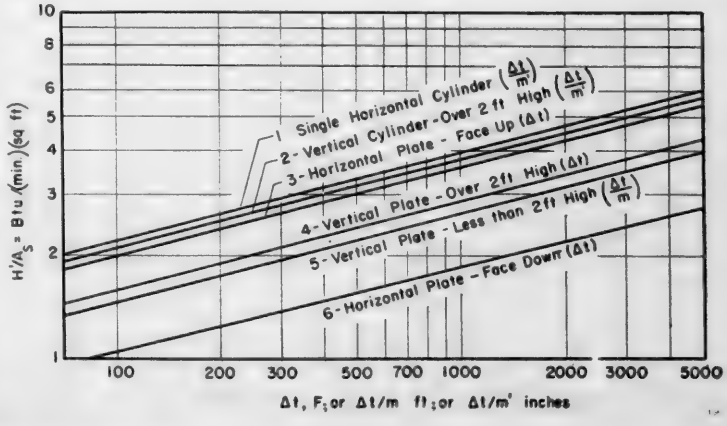


Fig. 4. Heat transfer from various hot bodies to air. Where vertical cylinder is less than 2 ft high, multiply H′/A from curve 2 by appropriate factor listed in Table 1.

travel and that the total air flow rate, q_s, at the level of the hood is only a little greater than the initial induction rate, q_θ, hence an equation for q_θ above horizontal heated surfaces would be a useful indication of the exhaust requirements for such low hoods.

Where no heat from steam is involved, the value of convectional heat from a horizontal plane is given by

$$H' = \frac{0.38}{60} A_s (\Delta t)^{5/4}$$

where A_s represents not only the horizontal hot surface from which the convection currents originate but also the face area of the canopy hood. When this expression is substituted in equation (5), noting that in this instance $A_s = A_p$, one obtains

$$q_\theta/A_s = 5.4m^{1/3}(\triangle t)^{5/12} \qquad (6)$$

Steaming Tanks

A similar simplification can be produced for the case where the heat is provided by steam from a tank of hot water. Letting G=pounds steam evaporated per minute per square foot, and taking the latent heat to be 1000 Btu per pound, we have $H'=1000\ GA_s$. On substituting this value in equation 5, one obtains:

$$q/A_s = 290 \sqrt[3]{Gm} \qquad (7)$$

It is emphasized again that these relationships require substantiation by experimental investigation. At this writing, such confirmation of them is lacking.

Booths and Partial Enclosures Above Hot Surfaces

Booth-type hoods which enclose the space above hot surfaces, such as pots of molten metal are canopy receiving hoods identical in their characteristics with ordinary canopy hoods which lack sidewalls. This may not at first be obvious but is easily demonstrated. Consider a canopy hood without side shields, above a rectangular tank of molten metal. Clearly, a vertical baffle could be inserted along either center line, extending from the hood face down to the hot surface, without modifying the air flow pattern in any way, since the baffle would coincide with a plane of air flow symmetry. The hood of Figure 5(b) operates like one-half of a canopy hood with a vertical baffle (the back wall). Now, additional baffles could be erected as in Fig. 5a, and, since they would coincide with the stream-lines of air flow, there would be no alteration in the flow pattern. The baffles described, however, have resulted in a series of booths over the tank. It follows, therefore, that specifying face velocity at a booth, or similar partial enclosure, over a hot surface is an incorrect basis. Like any canopy hood, the ventilation rate should be specified in relation to the flow rate of thermally induced air flow.

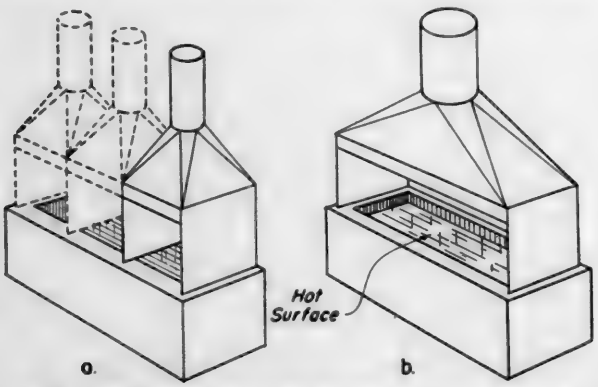


Fig. 5. Three booth hoods in (a) operate exactly as hood (b) which is actually a half of a canopy hood.

Small Area Heat Sources Under Large, Low Hoods

Previous discussion has dealt with heated horizontal surfaces with areas about the same as the face area, in plan, of the hood. Additional factors need consideration where the induced column of hot air is small in area relative to the hood, the area of the latter being determined by other considerations such as the following:

(a) The source of heated air is in motion, or is intermittently shifted within certain boundaries. For example, in pouring lead or high-lead bronze by ladle into molds disposed in a long row, a long narrow canopy hood might be employed to receive the fume-laden air regardless of the location of the ladle source. Similarly, pouring may take place in molds moving on a conveyor, but the required pouring rate does not permit a fixed position for the ladle.

(b) The source may be fixed, but adjacent operations or contaminant sources of different character, dictate the need for a hood larger than necessary for the hot air column alone. A hot plate in a laboratory hood illustrates this case. It has already been shown that a booth enclosing a hot body requires the same kind of analysis as a canopy receiving hood.

The key to performance of large hoods receiving hot air of small cross-section relative to the hood face area is illustrated by the following example (Fig. 6). Suppose a column of contaminated hot air of one square foot area flows at a rate of 250 cfm into a hood having a face area of ten square feet which is exhausted at a rate, also, of 250 cfm. There is one important factor in this situation operating to prevent complete control of the contaminated air stream. Since inflow to and outflow from

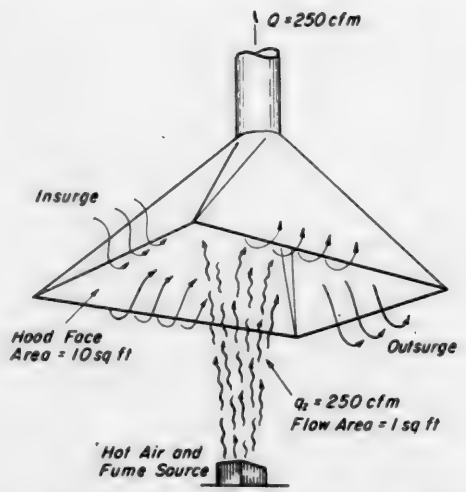


Fig. 6. Air flow pattern in a large area hood receiving a small hot air stream. Even where $Q=q_s$, surges may carry contaminated air out of the hood into the room.

the hood interior are equal, and inflow takes place entirely through one tenth of the hood face area, there is no *net* air motion inward nor outward through the remaining nine tenths of the hood face. Actually, turbulence universally prevalent in any air space will cause an undulating spillage of interior air, hence there will be both inward and outward flow, *averaging zero*, through the entire remaining area of the hood face. The greater the area of the hood face, the greater the chance for extraneous air currents to create a kind of "tidal wave" motion in the air under the hood, and result in spillage near the edges. Since the air within the hood interior will always be contaminated air, the spillage will carry a portion of the contaminant with it.

It is clear from this analysis that the dimensions of the hood face should not be greater than those of the column cross-section, unless the exhaust rate, Q, is made greater than q_z by an amount sufficient to create a brisk velocity through the inactive marginal areas. This means exhaust capacities equal to the hot air supply rate plus an amount sufficient to create controlling face velocities.

$$Q = q_z + VA_f$$

where Q is the required exhaust rate, q_z is the hot air induction rate, V is the required face velocity and A_f is the area of the hood face not occupied by the entering hot air current.

Values of V required are somewhat uncertain within limits as with controlling velocities in other situations—exterior hoods and cold process enclosures. Velocities of 100 to 150 fpm may be adequate in most cases where room air turbulence due to drafts is not excessive. Higher values would be indicated where very large quantities of a contaminant like lead fumes, having a low permissible concentration, are being generated.

A device which may occasionally be of value to eliminate tidal surges from the hood interior while minimizing the rate of exhaust required (where for mechanical reasons the gross hood area must be large in relation to that of the rising air column) consists of baffles across the face of the hood of such extent that velocities through the net area of openings are 200 to 300 fpm while the gross face velocity (cfm per square foot of gross face area) is 75 to 100 fpm.

High Canopy Hoods

The heated air stream originating from the surfaces of a hot body or from condensation of steam mixes turbulently with the surrounding air as it moves upward, becoming more and more diluted with increasing vertical distance. The "Low Hood" classification is intended to cover those situations in which the relative dimensions of hot body, air column, and receiving hood are such as to minimize the importance of such mixing. The "High Hood" group includes those where the vertical distance between source of heated air and the hood is great, relative to the diameter of the air column at its base. Then the vertical flow of contaminated air at the hood level is a function of both original flow at the hot surface and the quantity of air with which it has become mixed. For example, the contanminant may be entirely contained in an air stream of 1,000 cfm at the hot body; after some vertical travel it may have set in motion, and become mixed with, an additional flow of 100,000 cfm of surrounding air, all of which must be accommodated by the hood. (See Fig. 7.)

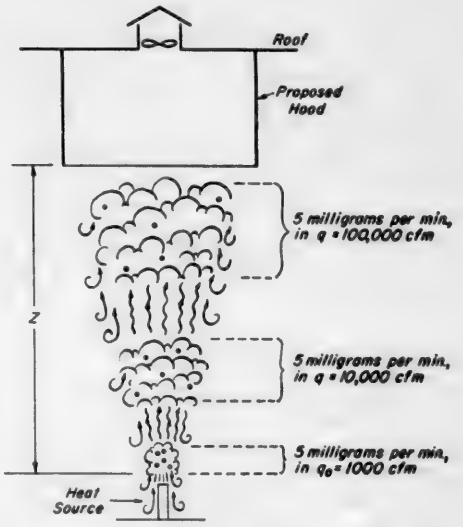

Roof
Proposed Hood
5 milligrams per min, in q = 100,000 cfm
Z
5 milligrams per min, in q = 10,000 cfm
5 milligrams per min, in q_0 = 1000 cfm
Heat Source

Fig. 7. By mixing with surrounding air, fume concentration becomes more and more dilute. Hood must exhaust the entire volume of air.

Sutton concerned himself with the mathematics of this problem having particularly in mind the rate of velocity decay in a hot gas column rising from a chimney top in the open atmosphere where there is no wind. His expression is based on the conception of a point source of heat so that an *effective distance* term must be derived, in the case of a source having finite dimensions, by extrapolation backwards to a hypothetical point source.

Transformation of Sutton's equation into English units, and condensation of terms gives the following equation for average velocity, V_z, of the rising column in feet per minute:

$$V_z = \frac{37}{Z^{0.29}} \sqrt[3]{H'} \qquad (8)$$

where Z is the *effective height* from the hypothetical point source to the location of interest, in feet; and H' is the rate of sensible heat transfer to the air column, in Btu per minute. (See Fig. 8.)

The diameter (instantaneous) of the column, in feet, is:

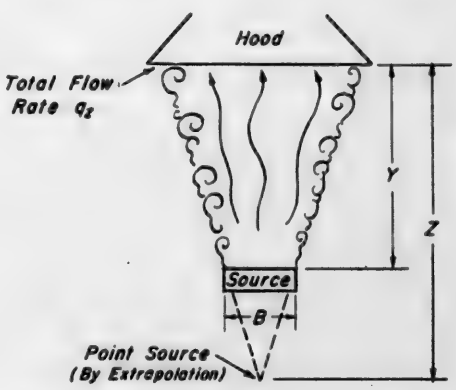


Fig. 8. Dimensions pertaining to equations (10) and (11).

$$D = \frac{Z^{0.88}}{2} \qquad (9)$$

A combination of these two equations by $q_z = VA$ yields an expression for air flow q_z at *effective* height Z,

$$q_z = 7.4Z^{3/2}\sqrt[3]{H'} \qquad (10)$$

The extrapolated distance from the actual heat source to the hypothetical point source may be taken as, approximately,

$$Z = Y, + 2B \qquad (11)$$

where Y is the distance from heat source to hood face, and B is source width.

Diversion from Vertical Flow by Cross Currents

Major hazards to successful performance of canopy hoods are adventitious horizontal currents of air which may tip the column away from the vertical and cause it to miss the hood. Large rising streams of air at high temperature with their greater vertical momentum are less easily diverted than smaller and cooler ones; also, obviously, the action is likely to be more serious, the greater the vertical distance of travel. If the diversion is likely to be only slight, larger hoods may take care of it, subject to the face velocity limitations discussed previously under "Low Hoods."

The same hazard may be encountered in low hoods. but there is more frequently opportunity for use of partial side walls as baffles to intercept room air currents.

Problem—A furnace 6 ft in diameter discharges fumes into the atmosphere which rise rapidly in a column of hot air. It is proposed to erect a canopy hood for ventilation but it cannot be placed closer than 15 ft above the furnace. The furnace releases *sensible* heat to the air stream at a rate of 1,000 Btu per minute (radiant heat is not considered). Calculate the rate of exhaust required and dimensions of the hood.

Solution—The distance Z is

$$Z = Y + 2B = 15 + 2(6) = 27 \text{ ft}$$
$$H' = 1{,}000 \text{ Btu per minute}$$

Hence, $q_z = 10{,}400$ cfm, from equation (10).

The diameter of the column is given by $D = \frac{Z^{0.88}}{2}$, but we shall approximate the diameter by assuming $D = \frac{Z}{2}$ to simplify what is at best only an estimate. This gives $D = 14$ ft.

By definitions written in the derivation, this pertains to the instantaneous position of the column, allowing for no waver. It would be well, then, to select a hood diameter materially larger, say 20 feet.

The exhaust rate must be sufficient to accommodate 10,400 cfm arriving, plus an additional amount sufficient to induce moderate inward velocities through the "dead" areas of the hood opening, in accordance with the expression

$$Q = q_z + VA_f$$

where A is the difference between a 14 ft square area and 20 ft square. The hood size selected. Let $V = 150$ fpm. Then

$$Q = 10{,}400 + 150\ (200)$$
$$= 40{,}000 \text{ cfm}$$

These figures, speaking for themselves, illustrate one reason why high canopy hoods are such a poor control method. In this example, three times as much exhaust capacity is devoted to taking care of increased hood size due to the hazard of column deflection from cross drafts.

Double Canopy Hoods. The spillage of hot air at the rim of the canopy receiving hood suggested to somebody long ago the remedy of the so-called double hood in which the central inner space of the main hood is blocked off by an inner hood of slightly smaller dimensions. Thereby, the air flow is concentrated at the rim of the hood structure, with only a portion permitted to pass to the inner space through a small orifice in the apex of the inner hood. It was reasoned that since hot air escaped at the rim of ordinary hoods, this would be prevented by disposing the major part of the exhaust capacity at this point. This form of hood, and the reasoning behind it has had rather wide acceptance, and it is therefore appropriate to examine it carefully at this point to separate fact from fancy.

It should be clear to the reader from the preceding exposition that a canopy receiving hood can function properly only when the buoyant flow of hot air is matched by an exhaust capacity at least as great in magnitude. This fact cannot be circumvented by any specially designed shape of hood. If, therefore, spillage occurs at the rim of a plain hood, this will not be prevented by inserting an inner piece to form a double hood.

We have seen that a large hood is subject to spillage from its interior by tidal surges, the remedy for which is in the exhaust of additional air and, if possible, by including baffles in the hood face. The inner piece of a double hood could be said to function as a hood face baffle, but the areas of orifices in the double hood are designed for air velocities of 1,000 to 2,000 fpm; while for resisting tidal spillage, velocities need not be greater than 200 to 300 fpm. Clearly, then, the double hood as such cannot be justified on the basis of its baffling function.

Lateral Exhaust for Hot Processes

The horizontal deflection of heated air into an exterior hood involves an interaction of forces that is quite different from the case where heat is absent. It is now insufficient to specify a velocity at some X-distance from the hood face which will overcome the dispersing effect of room air currents. Rather, it is necessary to induce a stream of air toward the hood which will overcome the tendency of the hot contaminated air to rise buoyantly away from the source and the hood.

While the relationships have not been quantitatively investigated, a qualitative consideration of the nature of significant forces makes it apparent that the required exhaust rate of an exterior hood must be a function principally of the X-distance, the area of the hot air column, and the thermal head developed by the temperature difference between hot air and room air.

Furthermore, the exhaust quantity must be greater than

q_o, the initial air induction rate; which is to say that, as with a canopy hood, the contaminant can be exhausted only by withdrawal of all the air with which it is mixed. The lateral exhaust hood must, in addition, develop the necessary deflecting force.

Example: A hot cylinder, 2 ft in diameter and 3 ft high, with surface temperature of 1,650F stands vertically on the floor. Toxic fumes are volatilized from its surface and are carried in the vertically moving hot air currents set in motion by the hot cylinder. In connection with plans for a canopy hood, estimate the rate of flow of convectional air currents.

Solution: Equation (5) and Table 1 apply.

The convectional heat loss, H', may be obtained as follows.

$$h_c = 0.4\left(\frac{\Delta t}{m'}\right)^{1/4}$$

$$= 0.4\left(\frac{1650 - 70}{24}\right)^{1/4} = 1.14$$

$$H = h_c A_s \Delta t$$

$$= 39{,}400 \text{ Btu per hr}$$

$$H' = 657 \text{ Btu per min.}$$

Area of the air column, A_s may be taken to be about equal to the cylinder, 3.1 sq ft.

The value, m, is about the height of the cylinder, 3 ft. Substitution in equation (5) gives

$$(q_o)^3 = 2.5 \times 10^4 (657)\,(3.1)^2 (3)$$

$$q_o = 780 \text{ cfm.}$$

If the hood were to be suspended within a couple of feet or so above the top of the cylinder, we can assume no significant additional mixing with surrounding air and would thus specify an exhaust rate of about 1,000 cfm into the hood to exceed the delivery rate, 780 cfm, by a suitable margin.

If the hood face dimensions be made a little larger than the hot air column, for overhang, say 3 ft by 3 ft, then an additional exhaust is required as indicated by the formula

$$Q = q + AV$$

Taking for V, 150 fpm,

$$Q = 780 + (9\text{-}3.1)\ 150$$
$$= 1{,}700 \text{ cfm as a rounded number}$$

ENCLOSURE FOR HOT PROCESSES

Exhausted enclosures, the air in which is hotter than the outside air, may permit the escape of air with contaminant through openings near the top in some circumstances. This phenomenon may sometimes be observed in drying ovens having small openings or cracks at the top or which are open at the ends; in canopy hoods with access openings near the top; and even from the top portion of the doorway to a room in which large amounts of heat are generated and from which air is being exhausted. It may also be observed at the top of the face of an exhausted booth which contains a heated process.

It is of some importance in the design of ventilation for hoods and enclosures to understand the thermal forces responsible for such escape.

Heated Air

A diagram representing the conditions in an exhausted enclosure or canopy hood which is filled with hot air or gases from a process is shown in Fig. 9. Pressure-flow relations for this situation are described by the expression,

$$h_{th} = L\ (1 - s_h)$$

where h_{th} is the thermostatic head, feet of air; s_h is the specific gravity of the interior hot air relative to that of the cooler room air, and L is the height in feet of the mass of hot air in the enclosure.

$$\text{But } s_h = s_c \times \frac{T_c}{T_h} = 1 \times \frac{T_c}{T_h}$$

where s_c = specific gravity of the cooler air of the room, and is equal to unity, since it is made the point of reference

T_c = absolute temperature of cooler air
T_h = absolute temperature of hot, interior air

Thermal head then becomes

$$h_{th} = L\left(1 - \frac{T_c}{T_h}\right) = L\left(\frac{T_h - T_c}{T_h}\right) = \frac{L\Delta t}{T_h}$$

The value of h_{th} so obtained is in feet of air and may therefore be used directly in the equation $V = C\sqrt{2gh}$ to ascertain velocity through the orifice, where C is the orifice coefficient. Therefore,

$$v = C\sqrt{2 \times 32.2 \times \frac{L\Delta t}{T_h}}$$

$$= 8.02\ C\sqrt{\frac{L\Delta t}{T_h}}$$

Note that v = velocity in feet per second.

The value L cannot be greater than the vertical depth of the hood or enclosure although it might be less. Ordinarily it will be taken as equal to the height of the enclosure, or the distance from the bottom of the opening where room air enters, to the location of the orifice.

The magnitude of $\triangle t$ is fixed by the rate of generation of heat, H', in Btu per minute, and the total rate of exhaust, Q, cfm.

$$\text{Since } H' = Q\ (0.075)\ (\triangle t)\ (0.24)$$

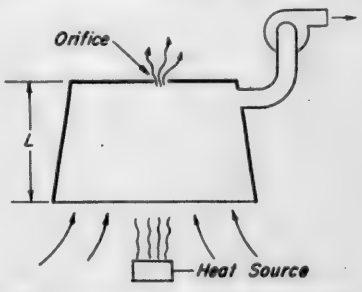
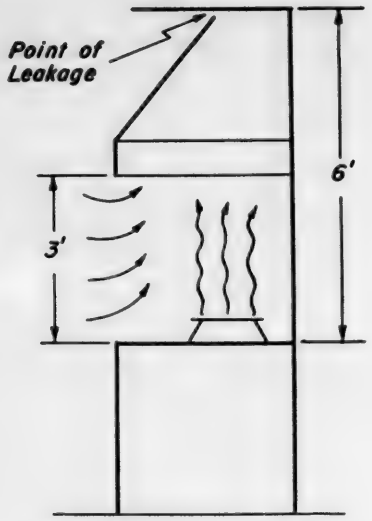


Fig. 9. Leakage prompted by thermal head.

Fig. 10. Illustration of example in column at right.



Then $\triangle t = 58 \dfrac{H'}{Q}$

where 0.075 is the density of air at ordinary room temperatures, 0.24 is specific heat of air.

$$T_h = 460 + (\text{room temp.}) + \triangle t$$

Ordinarily $T_h = 530 + \triangle t$

Orifice Velocities Due to Thermal Head

The equation for velocity can be transformed further by use of $\triangle t = 58H'/Q$, and by $Q = VA_f$, changing from v (fps) to V (fpm), and using an appropriate value for C. Very commonly, the orifice of interest will be sharp-edged where $C = 0.60$.

Also, the term $\sqrt{530 + \triangle t}$, which occurs in the transformation, changes only slightly, with considerable ranges in $\triangle t$. For values of $\triangle t$ between zero and 200F this term is always within ten percent of 25. Substituting these values gives

$$V = 20\left(\frac{LH'}{A_f}\right)^{1/3}$$

as the face velocity through sharp edge openings where the temperature rise lies between zero and 200F.

If $\triangle t$ is greater, then a constant different from 20 will apply as indicated in the equation summarized in Table 2.

Preventing Leakage

The most important application of the relationships developed in the preceding section is in estimating the possibilities of spill in a hood or enclosure being designed, and in designing preventive measures.

It is clear, in the first place, that the enclosure should be so constructed that there is no possibility of cracks or other orifices in its upper section. This is especially important in design of ovens. Where orifices cannot be avoided for operational reasons, leakage can be prevented by adequate exhaust.

The force responsible for leakage of air through the orifice is, as has been demonstrated, the thermostatic head. If the exhaust arrangement be such that a negative static pressure is created inside the enclosure equal to or somewhat greater than the thermostatic head, then leakage will be prevented. The velocity of escape through orifices described in Table 2 are therefore those which must be induced by an exhaust system to overcome the air escape tendencies. In other words the expressions given in Table 2 are the *Required Face Velocities for Heated Enclosures* where leakage through openings at the upper part of the enclosure is to be prevented.

TABLE 2. AIR VELOCITIES THROUGH A SHARP-EDGE OPENING DUE TO THERMAL HEAD

Temperature elevation in interior, deg F	Face velocity, feet per minute
0-200	$V = 20\left(\frac{LH'}{A_f}\right)^{1/3}$
200-400	$V = 18\left(\frac{LH'}{A_f}\right)^{1/3}$
400-600	$V = 16\left(\frac{LH'}{A_f}\right)^{1/3}$
600-800	$V = 14\left(\frac{LH'}{A_f}\right)^{1/3}$

L = height of hot air column, feet.
H' = sensible heat released to air stream, Btu per min.
A_f = area of sharp-edge openings, sq ft.

Example: A rectangular laboratory type hood is 6 ft high from bench top to the flat top of the enclosure. The face opening is 4 ft wide and 3 ft high from the bench top. It encloses a hot plate which burns natural gas at a rate of 0.1 cfm. (Heating value is 1,100 Btu per cu ft). Air is exhausted from the hood at a rate to induce a face velocity of 60 fpm. (See Fig. 10.)

Cracks at the top of the hood amount to 0.05 sq ft. Calculate the velocity and volume of escape of interior air through these cracks.

Solution: Using the expression, $V = 8.02\ C\sqrt{L\ \triangle t/T_h}$, assume the cracks behave as sharp-edge orifices where $C = 0.60$. The height of hot air column, L, may be taken to be that from the top edge of the opening to the top of the enclosure (6.3 = 3 ft.). Temperature rise, $\triangle t$, is given by $\triangle t = 58 \dfrac{H'}{Q}$, where H' is 0.1 × 1,100, or 110 Btu per minute. The exhaust rate, Q, is 60 (4 × 3) = 720 cfm. Hence, $\triangle t = 9$ degrees. The absolute temperature of interior air, T_h, is 530 + 9 = 539 degrees. Then

$$v = 8.02(0.60)\sqrt{\frac{3(9)}{539}}$$

$$= 1.1 \text{ fps or } 65 \text{ fpm.}$$

Rate of air escape through cracks is, then, 0.05 × 72 = 3½ cfm.

The calculation can also be made using the formula

$$V = 20\left(\frac{LH'}{A_f}\right)^{1/3}$$

which yields the same result within approximately 10%. While this is a very small air flow, it may be significant where the interior air is highly malodorous, or where radioactive contaminants are being handled.

Centrifugal Pumps—Impellers and Wearing Rings

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Third in a series of independent articles on various aspects of centrifugal pump design and selection, this discussion analyzes the forms and functions of impellers and the structure of wearing rings.

THE impeller is the heart of the centrifugal pump. It rotates the mass of the liquid and the peripheral speed of its vane tips determines the head produced or the working pressure of the pump.

On the basis of the supply to the impeller inlet, impellers are classified as (a) single suction impellers and (b) double suction impellers. A single suction impeller is one where the liquid pumped enters the impeller suction on one side only, while a double suction impeller is, in effect, two single suction impellers arranged back-to-back in a single casting, so that the liquid pumped enters the impeller from both sides. The suction chambers located at each side of the impeller are connected to a common suction passage and a single suction nozzle.

Single suction impellers are preferred in certain applications for structural reasons. End suction pumps with single suction overhung impellers present certain advantages which cannot be obtained with a double suction impeller. Thus, in general, all radially split casings house single suction impellers. Because an overhung impeller does not require the extension of a shaft into the impeller suction eye, single suction impellers are preferred for pumps handling suspended matter such as sewage. In multi-stage units, the use of double suction impellers carries with it certain shortcomings which have led to an almost universal use of single suction impellers.

The single suction impeller is more practical than the double suction type in small capacity units for manufacturing reasons, since its waterways are not divided into two very narrow passages.

The double suction impeller is favored for general service, single stage, axially split casing, centrifugal pump designs intended for the range of capacities beyond the field of end suction single stage pumps, for two reasons; first, it is theoretically in axial hydraulic balance and, second, the greater suction area available in a double suction impeller permits the pump to operate with less net absolute suction head for a given capacity than is possible with a single suction impeller.

The shape or the form of the vanes divide impellers into several distinctive types:

(a) The straight vane impeller (Fig. 1);
(b) The francis vane impeller (Fig. 2);
(c) The mixed flow impeller (Figs. 3 and 4);
(d) The propeller or axial flow type (Fig. 5).

In a straight vane impeller, the surfaces of the vanes are generated by straight lines parallel to the axis of rotation. Vanes of this type of impeller are also called single curvature vanes.

In a francis vane impeller the vane surfaces have a double curvature. This type of impeller is also often called the francis screw vane or screw vane impeller.

An impeller design in which there is both a radial and axial component of flow is called a mixed flow impeller. It is generally restricted to single suction designs having a specific speed above 4200. Lower specific speed types are called francis vane types. Mixed flow impellers having a very small radial flow component are generally classified as propellers.

A true propeller or axial flow impeller is one having a flow solely in the direction of the axis or rotation, in other words, strictly axially.

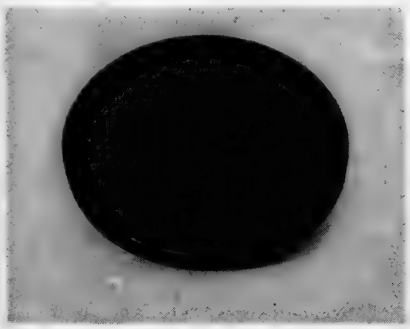


Fig. 1. Straight vane, single suction, closed impeller.

Fig. 2. Francis vane, double suction impeller.

Fig. 3. Mixed-flow impeller.

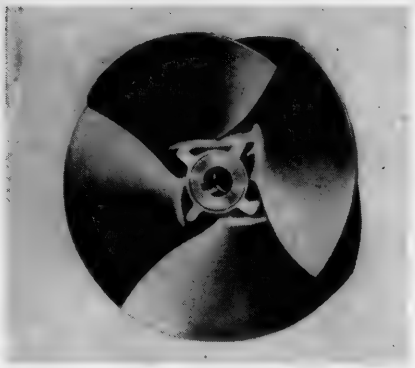


Fig. 4. End view of mixed-flow impeller shown on Fig. 3.

Fig. 5. Axial flow impeller.

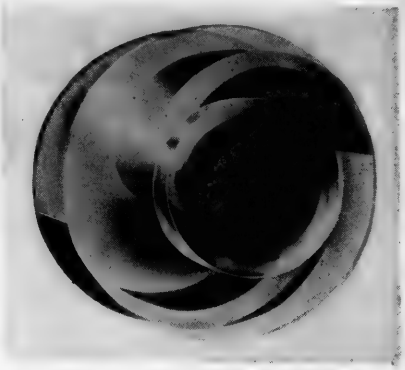


Fig. 6. Non-clogging impeller.

In addition, there are a great number of impellers specifically designed for a particular duty. For instance, for handling liquids containing rags, stringy materals and solids like sewage, the conventional impeller design with sharp vane edges and restricted areas is not suitable as it will become clogged. Special designs with blunt edges and large waterways have been developed and are known as non-clogging impellers. Such an impeller is shown in Fig. 6. For pumps up to 12 to 16 inches in size, these impellers are made with only two vanes. With larger pump sizes, three or four vanes are generally used.

Impellers are also classified as to their mechanical construction, such as a completely open impeller, a semi-open impeller and a closed impeller.

An open impeller (Fig. 7 and 8) consists of vanes only, attached to a central hub for mounting on the shaft without any form of a side wall or shroud. With long vanes this is structurally weak and the vanes have to be strengthened by ribs or a partial shroud. Generally, open impellers are used for small inexpensive pumps or for pumps handling abrasive liquids in which the impeller rotates between two side plates, between the casing walls of the volute or between the stuffing box head and the suction head. Because of the clearance between the blades or vanes of the impeller and the side walls, there is a certain amount of water slippage, similar to the slip in a reciprocating pump. This slippage increases as wear increases the clearance between the impeller and the stationary side plate. To restore the original efficiency it is necessary to replace both the impeller and the side plate, a much larger expense than involved for closed impeller pumps where simple rings form the leakage joint.

The semi-open impeller (Fig. 9 and 10) has a shroud, or an impeller backwall. This shroud may or may not have pump-out vanes, which are vanes located at the back of the impeller shroud. Their function is to reduce the pressure at the back hub of the impeller. An additional feature of the pump-out vanes is that should the pump handle suspended foreign matter, these vanes prevent it from lodging back of the impeller and interfering with the proper operation of the pump and of the stuffing box.

The closed impeller, which is almost universally used in centrifugal pumps handling clear liquids, has shrouds or enclosing side walls, thus forming totally enclosed waterways in the impeller from the suction eye to the periphery. While this prevents the slippage of water that occurs between an open or semi-open impeller and its side plates, a running joint must be provided between the impeller and the casing to separate the discharge and suction chambers in the pump. This running joint is generally formed by a relatively short cylindrical surface on the impeller shroud rotating within a slightly larger stationary cylindrical surface. By making one or both surfaces renewable, the leakage joint can be renewed when wear causes the leakage to become excessive.

If the pump shaft terminates at the impeller so the impeller is supported by bearings on one side only, the impeller is called an overhung impeller. This type of construction is most advantageously used for end-suction pumps with single suction impellers.

Fig. 7. Open impellers.

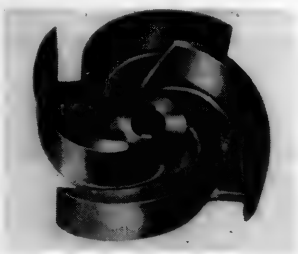


Fig. 8. Open impeller.

Fig. 9. Semi-open impeller.

Fig. 10. Semi-open impeller with pump-out vanes. Front view at left, back view at right.

The inlet of an impeller just before the section at which the vanes start is called the suction eye. In a closed impeller pump the suction eye diameter is taken as the smallest diameter of the shroud. In determining the area of the suction eye, the area occupied by the impeller shaft hub is deducted.

By definition, a hub is the central part, usually cylindrical, of a wheel. In the case of a centrifugal pump impeller it should be applied to one part of the impeller only; that is the central part of it which is generally bored out to receive the pump shaft. The expression, however, is also frequently used for the part of the impeller which rotates within the casing fit or within the casing wearing ring, in which case reference is made to the outer impeller hub or to the wearng ring hub of the shroud. Parts of a double suction impeller are shown in Fig. 11.

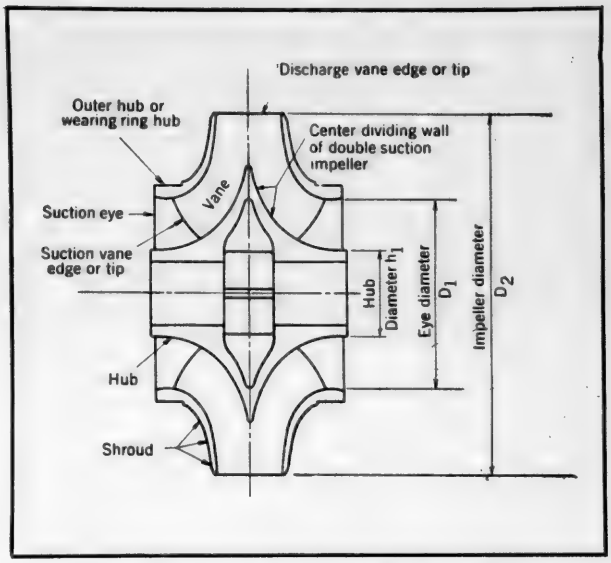


Fig. 11. Parts of double suction impeller.

Wearing Rings

In order to avoid wear at the adjacent surfaces of pump casing and impeller, separated by running clearance joints, removable rings are used at such joints. The wear is then taken on a part or parts replaceable at a lower cost than would be the case if the casing or the impeller had to be renewed.

The casing wearing ring, sometimes called impeller guide ring is a removable ring inserted in the casing to protect the latter from wear and in which the impeller running joint rotates.

When it is desired to protect the impeller from wear at its running joint within the casing or casing ring, the impeller is fitted with a removable ring which is called an impeller wearing ring.

When a pump has renewable rings both on the impeller and in the casing, it is said that the pump is provided with double wearing rings.

Present day tendency of nomenclature is towards the omission of "wearing" using merely casing ring, impeller ring and double rings.

The most desirable type of ring construction varies with the character of the liquid being handled, the head differential across the leakage joint, the rubbing speed and the particular pump design. Generally speaking, pumps have ring designs which the manufacturers have found by experience to be suitable for the service for which the pump will be used.

Flat ring. A flat ring is a type of wearing ring in which the leakage joint is a straight annular clearance as illustrated in Fig. 12 (a), (b) and (c). This type of ring has been replaced very extensively by the L type ring shown in Fig. 12 (e) and (f). The flat and L-type rings are the most commonly used types of rings.

L-shape ring. The L-shape casing ring, or the nozzle type ring as it is commonly called, takes its name from the fact that it is fashioned in the shape of an L laid on its side, with the short bar of the L covering up the radial face of the impeller or impeller ring which would otherwise be exposed to the incoming flow. This construction avoids the emergence of the wearing ring leakage into the

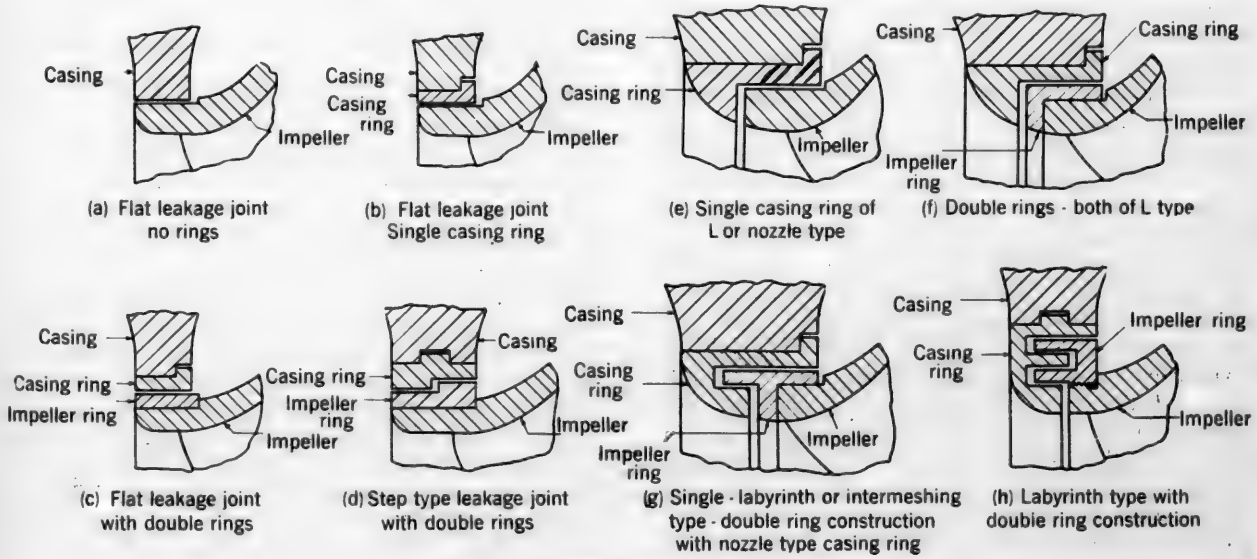


Fig. 12. Various wearing ring designs.

suction stream at an angle almost perpendicular to the flow of liquid, a condition which would cause induced currents and hydraulic losses. The leakage joint proper is along the long bar of the L with the clearance on the short bar of the L being large. The L-shape ring is basically a flat ring with a protecting apron.

Labyrinth rings. A labyrinth ring has two or more annular clearance leakage joints connected by relief chambers with low flow velocities. See Fig. 12 (h). As the leakage through a ring is a function both of the area and the length, the longer leakage path of the labyrinth ring permits the use of a larger area so larger clearances between the rotating and stationary rings can be used. The step ring and the intermeshing ring are both subdivisions of the labyrinth ring group.

A labyrinth ring with two annular clearance joints of different diameters involving one reversal of flow, is often called an intermeshing ring. See Fig. 12 (g).

A step ring is the name applied to a wearing ring design utilizing, in effect, two flat ring elements of slightly different diameters on the total width of a leakage joint. It is not very commonly used. See Fig. 12 (d).

Wearing Ring Location

The amount of leakage thru a leakage joint is controlled by three major factors: the area, the length of the path, and the differential pressure. The leakage is likewise somewhat affected by the manner in which the designer provides acceleration and deceleration of the flow through the clearance joint. To obtain the minimum area so the leakage will be a minimum, it follows that the leakage joint should be at the smallest possible diameter, and, thus, the logical location is at the impeller eye.

Besides having the disadvantages of increased area and of increased rubbing speed, locating the rings at the periphery would not be desirable for application in regular commercial lines as the impeller diameters used in the same size of casing vary over a wide range.

Mounting of Wearing Rings

When the pump casing is split axially, it is the general practice to either hold the casing ring in place by means of a pin which engages partly in the ring and partly in the lower half of the casing itself, or to provide a tongue-and-groove joint in the lower half of the casing so that the bolting of the two casing halves firmly locks the casing ring in place and prevents it from rotating. If the pump casing is radially split, the casing rings are pressed into the casing or into the stage piece and, sometimes, bolted.

Depending upon the type of pump, the intended service and the expected frequency of impeller ring renewal, the latter may be pressed or screwed on the impeller hub. In addition, it is the general practice to hold the impeller ring in place by means of set screws, or other fastening devices.

There have been some designs of wearing ring mounting, where the impeller ring is shrunk onto the impeller. This design, of course, is restricted to materials which permit such an assembly.

Next month the authors will analyze the significance and control of axial thrust.

Corrosion of Nickel Cast Irons in Soils

The National Bureau of Standards has recently completed a long-range study of the corrosion of nickel cast irons in soils. From measurements on pipe specimens after exposure to different soil conditions for periods up to 11 years, it has been possible to evaluate the effect of varying amounts of nickel in the castings.

The study included samples of plain cast iron, low-alloy cast-iron pipe (1.27 nickel, 0.32 copper; 1.17 Ni, 0.98 Cu; 3.32 Ni), low-alloy cast-iron plate (2.08 Ni, 1.10 Cu; 3.10 Ni), and specimens of high-alloy cast-iron pipe (15.0 Ni, 6.6 Cu, 2.6 Cr). The specimens consisted of lengths of pipe 10 to 14 inches long and 1.5 to 2.5 inches in diameter. Moisture was excluded from the interior by means of cast-iron screw caps of the same composition as the pipe. As an extra precaution against internal corrosion, the inner surfaces of the specimens were coated with heavy grease.

Weight losses and depth of pitting were correlated with the composition of the specimens and the type of soil environment to which they were exposed. From the standpoint of both criteria, the high-alloy cast iron was considerably more resistant to corrosion than either the plain cast iron or the low-alloy cast irons. Except in cinders, the deepest pit measured on the high-alloy specimens was only 74 mils after 14 years of exposure.

In the low-alloy cast irons, additions of nickel up to 3% were found to reduce initial corrosion in poorly drained soils of low resistivity, but this advantage was not maintained for the duration of the tests. Thus, the weight losses of the low-alloy cast irons exposed for the maximum period did not differ greatly from the losses of the plain cast iron. Hence, it would appear that the rates of corrosion of the alloys containing as high as 3% nickel decrease less with time than do the rates for plain cast iron and the alloys containing smaller amounts of nickel.

Measurements of hydraulic bursting pressure were also made on samples of the nickel cast irons after exposure to the different soil conditions. After exposure at the test sites for periods up to 11 years and storage in the laboratory for approximately one year, most of the specimens withstood a maximum pressure of 500 lb per sq inch, even though the subsequent removal of the corrosion products revealed numerous holes of various diameters. Most of the low values of bursting strength that were obtained probably were not accurate measures of the strength of the corroded pipe at the time of its removal from the soil since these low values may have resulted from oxidation of the corrosion products during storage or damage to the pipe in handling and shipment. Hence, it is reasonable to assume that undisturbed buried cast-iron pipe, even in an advanced state of graphitic corrosion, is able to withstand the minimum pressure required of class 150 pipe.

APART from the day when your Correspondent fell asleep instead of writing last month's *Letter*, there has been no summer in these Islands since *H. M. Y. Britannia* arrived in The Thames with the Queen on board. Even Blackpool, which claims to be the world's largest holiday resort with 5,000 hotels and boarding-houses and 7,000,000 visitors annually, offered only high winds and showers of rain to a Conference which included representatives from the U. S. It seems not inappropriate therefore to look at the climate control arrangements on this ship, more especially since air conditioning aboard ships was featured in a recent issue of this publication.

All at Sea

With the permission of Her Majesty, Sir Victor Shepheard, Director of Naval Construction, described the Yacht at a meeting of the Institution of Naval Architects in London on April 7, and his paper will be published in Volume 96 of the Institution's *Transactions*. He stressed the urgency which affected all aspects of the design and construction and also the dual purpose of the ship. Designs had to be developed simultaneously for the rôles of Royal Yacht and Hospital Ship. Certain features have been embodied in the design which add to the value of the ship as a Royal Yacht but which are not altogether essential for that purpose. They would, however, be necessary if and when the ship is used as a hospital ship. Such features include ship's stabilizers, large laundry facilities and certain air conditioning.

If conversion to a hospital ship becomes necessary, wards accommodating 200 patients will be located in the after part of the ship now laid out as State Apartments and as accommodation for Royal Household and Staff. Most of the patients will be medical and surgical cases, but provision will also be made for those suffering from infectious diseases. The latter will be accommodated in glazed cubicles built within the drawing-room. The galley is of such a size and is so equipped that for hospital ship service it could provide suitable food for all the patients, although a little additional equipment would be required for any Asiatics who might be embarked. Ranges, grills and ovens are all electric, steam being supplied only for steam cookers and boiling coppers. The serveries for distributing the food are equipped with adequate hot cupboard and automatic refrigerator capacity. There are two cold rooms (10F) for meat and fish, one large enough to provide supplies for the ship's company for 45 days, and the other for the Royal party for considerably longer. The dairy room (32F) and the fruit and vegetable room (35F) are of sufficient capacity to meet the requirements of the ship for 30 days. An ice-making cabinet in the cooling machinery compartment makes 500 lb of ice per day. The cooling machinery consists of two electrically-driven water-cooled plants using Freon-12/Arcton-6 as the refrigerant. The cold and cool rooms, as in modern naval practice, are refrigerated by air recirculation. Normal brine arrangements are provided for the ice-tank.

An air conditioning system serves the spaces which will be the hospital section of the ship in this rôle. Both tropical and arctic conditions have to be considered. The system is designed to maintain 85F dry bulb and 71F wet bulb inside with conditions 88F and 80F outside. In cold weather an inside temperature of 70F will be maintained with 30F outside. The machinery comprises two steam-jet vacuum type plants each capable of extracting a million Btu per hour, and the cooling medium is chilled water circulated to thirteen air conditioning units each serving a particular section of the ship. Warm water is used for heating. Automatic temperature and humidity controllers are provided for each section.

Special attention has been paid to the ventilation installation and care has been taken to keep noise levels to a minimum. Low speed fans have been resiliently mounted in acoustically lined chambers, and trunking has been acoustically lined where necessary. These efforts to reduce noise and vibration have dictated the choice of steam turbines instead of diesels for the main propulsion engines, and elaborate calculations of resonance frequencies at various cruising speeds showed that four-bladed propellors would be better than three-bladed as regards vibration.

There is no recirculation of conditioned air, fresh filtered air being used for all purposes. The forward quarters for the ship's company are ventilated by fan supply and exhaust. They are manually controlled, and heaters capable of maintaining 70F within with 30F outside are

H. M. Y. Britannia. Photo courtesy British Admiralty.

installed. Galleys, bathrooms, workshops, etc., are ventilated at atmospheric temperature. The wireless offices are air conditioned with a small separate refrigerating unit. A particular feature of the layout of the ductwork was to ensure that no watertight bulkheads were pierced by it. Watertight slide valves are fitted to the few places where this is unavoidable.

Animal Houses

No excuse can possibly be good enough to justify discussing air conditioning for royalty and for rats in the same *Letter*. A symposium on the Design of Animal Houses must, therefore, be reported without inventing any excuse at all. This took place in May under the auspices of the Laboratory Animals Bureau, a branch of the Medical Research Council located at Holly Hill, London, N.W. 3. The papers presented covered a wide range and will shortly be printed as Volume II of L. A. B. Collected Papers. Judging by the size of the audience there is a growing interest in improving conditions in animal houses here, not only for the animals themselves but also from the point of view of those humans who have to work in them.

Dr. A. S. Parkes, F.R.S., reported on developments at the National Institute for Medical Research under the title Modernizing the Animal House. He was mainly concerned with arrangements for feeding and for hygiene, and particularly with the need for flexibility in the layout of cages, etc. He considered that air conditioning was very desirable, but pointed out that it requires a lot of machinery to be fully automatic. In his new house ventilation at the rate of seven air changes an hour was maintained by a system which made some use of the corridors as air ducts and which worked very satisfactorily.

Much of the symposium was concerned with actual construction, fly-proof windows, washable walls and floors and so forth. In this connection there appeared to be a preference for asphalt floorings; although it becomes damaged it is easy to cut out the bad places and repair it. It cannot, however, be used with floor panel heating, and neither can some of the newer plastic tiles suggested as suitable for acid-resisting floors by J. Matthews. He was speaking at short notice in place of Gastrell Lewis who was to have made the major contribution on the heating and ventilating side. He was supported by Dr. T. Bedford who, also at short notice, put before the conference the principles of cool ventilating air and a high mean radiant temperature which he considers are preferred by humans and which would probably suit most other animals.

For walls, hard plaster or a painted cement finish were chosen in most cases. Tiles of any kind suffered the disadvantage that there had to be joints between them. In the new small animal unit of the Lister Institute, B. Weitz reported that the bottom 10 inches of the walls form a skirting continuous with the floor. In the Zoology Department at Bangor University (North Wales) all electrical equipment is kept well up so that the lower parts of all walls can be hosed down. This building is at present in course of construction and thus represents the latest practice. It is of interest that each room will be fitted with a thermostat, set between 60F and 70F.

Keen interest was shown in a paper by Wentworth Cumming whose mouse farm in New City, N. Y., produces two million mice a year. The author was not present in person, and the paper was read for him by Dr. Lane-Petter who managed to deal with several questions that were raised. In view of the information in the paper that animal quarters in the East and Mid-West U. S. A. are fully air conditioned it was surprising to be told that this did not apply to Mr. Cumming's own farm, and to learn further that wooden cages were used in preference to metal although the mice gnawed the wood. Apparently the little things like surroundings that are not too artificial, and breed better in consequence. Is there a moral of some sort here?

Getting Into Hot Water

The fine ship available in this letter provides an opportunity for a trip to Iceland to inspect a unique district heating system. There are about 700 hot springs in the island, as well as few holes from which steam is emitted. Since all fuel has to be imported this heat supply has not been neglected. If your house was near a steam hole you ran some pipes over to it and connected up an old radiator as a heat exchanger to supply hot water for central heating; and the women of Iceland have long done their weekly wash in the hot springs.

In 1928 some boreholes were put down to tap the underground sources, and results were so encouraging that a system was planned for district heating in the whole of the capital city, Reykjavik. The first house was connected about ten years ago, and 2400 were connected in six months. At the beginning of this year the number connected was 3320. Water from boreholes in a field near Reykir about 11 miles north of the city is available at 186F. There is some removal of suspended solids in settling tanks, and the water is then pumped through two 14-inch diameter insulated pipes to five insulated storage reservoirs on a hill near Reykjavik. The rate of flow from the boreholes is about 100 gallons per second, and each reservoir holds nearly 300,000 gallons. The insulation, by peat and powdered pumice, is not so good as was originally intended, and the temperature has dropped to about 167F when the water reaches the houses. It flows once through the heating system and is then run to waste, entering the sea at about 104F.

On an annual basis there is plenty of heat available for the whole city. But peak demands mean that only about two-thirds can be supplied at present. There are plans for tapping another field to the south, but there is the possibly more economic alternative of installing oil-fired boilers to reheat and re-circulate the warm water now run to waste. Little fuel would be used, since it would be needed only in the very coldest weather. As now operated the scheme is reckoned to save the equivalent of 50,000 tons of coal a year, and as an investment it has been attractive, yielding an annual return of 20% of the capital cost. There are no worries that the supply of heat might fail. The possibility of lowering the water-table by running such large quantities of fresh water directly out to sea are, however, giving cause for concern, and acting as a brake on the wholesale development of this idea for other towns on the island.

These few notes on Iceland have been taken from an excellent article by F. van Hoorn writing in *Verwarming en Ventilatie* (**11**, 2, 22), Holland's leading journal in the heating and ventilating field.

Louis Blendermann on

PIPING

and PLUMBING

Location and Construction of Dry Wells

EVERY so often the engineer and designer encounters a problem concerning the disposal of rain water that will fall on the roof of a proposed building. This problem is a difficult one, especially when there are no available storm sewers, brooks, streams, or other points of discharge at the site to which the rain water may be conducted, and it is further complicated when the nature of the area or the ground is such that this water must be disposed within the property limits.

While there are several solutions, in this article we shall consider only the method that uses dry wells. The function of a dry well is, therefore that of an underground receiving tank into which the rain water flows and from which, by reason of its construction, this water is recharged into the earth.

The purpose of this article is to point out features of design in location and construction, that will enable the dry well to provide many years of trouble-free service and efficiency in operation.

Location of Dry Wells

Before the dry wells are located, several factors must be considered, as follows:

(1) Rainfall and total roof area to be drained, which will determine the size and number of required dry wells.

(2) Proposed grouping of leaders for the purpose of leaving the building with as few storm sewers as possible.

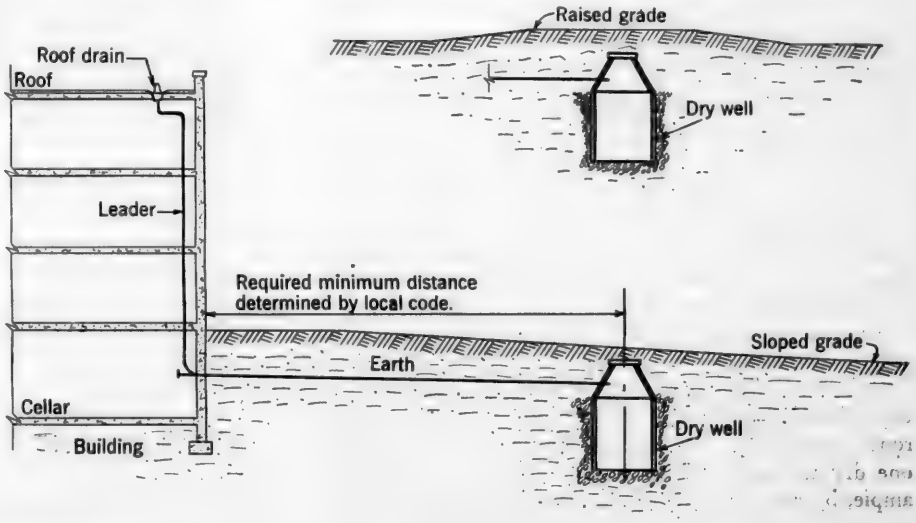
(3) Characteristics of the soil and the level of the possible ground water, both of which will affect the location of the dry wells. Often when ground water is a condition, it will be necessary to construct two or more shallow type dry wells which are located above the water level.

(4) Future construction of a public storm sewer near the property, into which the rain water may then be diverted, is a matter which should be discussed with the local sewer or highway departments. If the construction of such a sewer is proposed at a future date, the engineer should, if possible, so locate the dry wells, that when the public storm sewer is installed, the dry wells could be filled with earth and the storm water lines extended to the public storm sewer system.

These considerations have a definite bearing on the design and location of the proposed rain water disposal system. Once the location of the dry wells has been determined, it is important to see that they will operate at full capacity. Using one dry well as an example, a recommended location and installation is shown in Fig. 1.

As shown in Fig. 1, the dry well is preferably installed in sloping ground. If the grade is level or slightly depressed, then the grade over the dry well should be raised and sloped away as indicated. This practice will prevent surface water from accumulating and seeping into the

Fig. 1. Typical location of a dry well. Where ground level is depressed, it must be raised as indicated



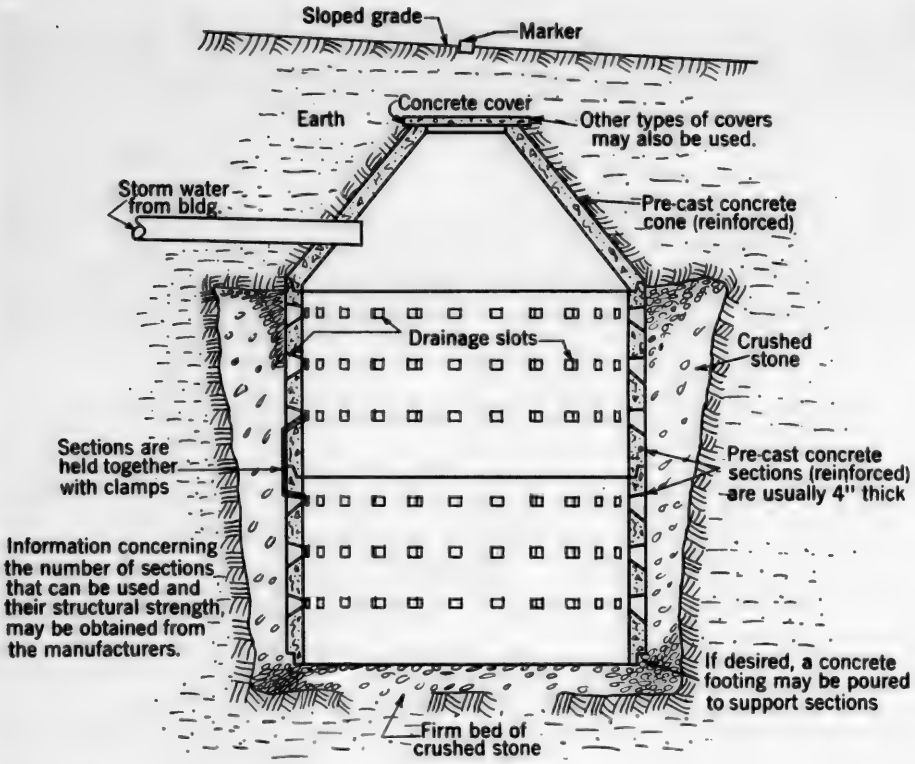

Sloped grade
Marker
Earth
Concrete cover
Other types of covers may also be used.
Storm water from bldg.
Pre-cast concrete cone (reinforced)
Drainage slots
Crushed stone
Sections are held together with clamps
Pre-cast concrete sections (reinforced) are usually 4" thick
Information concerning the number of sections that can be used and their structural strength, may be obtained from the manufacturers.
If desired, a concrete footing may be poured to support sections
Firm bed of crushed stone

Fig. 2. Installation details of a dry well constructed of pre-cast concrete sections

dry well thereby reducing its effective capacity. Many dry well installations of adequate size and construction have failed in their purpose because surface water accumulation had not been taken into account. To avoid this occurrence, it is necessary to inform the prospective contractor of the desired procedure to be followed with regard to the treatment of the grade over the dry well as shown in Fig. 1. This can be accomplished by means of a brief note of explanation added to the detail of the dry well on the drawings or by a short paragraph covering the installation of the dry well, included in the specifications.

Determining Size of Dry Well

The size of a proposed dry well is governed by the following:

(1) Rate of rainfall prevalent in the area.

(2) Total roof area to be drained.

The rate of rainfall prevalent in the area, based on the intensity of rainfall in inches per hour, and the time of concentration in minutes, will determine the required size of dry well for a given roof area. The heaviest rainfall will occur during a fractional part of a storm, and the dry well is usually sized for this concentrated flow. Tables of the records of rainfall for any given area may be obtained at local United States Weather Bureau stations. Since the rainfall rates given in the tables are based on the greatest intensity over a number of years, it is safe to assume that the dry well will be of more than ample size.

Once the rainfall rate has been decided upon, it must be applied to the total roof area to be drained. For very large roofs, several dry wells may be required; for small roofs, one dry well may suffice. Using a small roof as an example, by applying the rainfall rate to the total area, the resultant flow of water can be quickly determined. The dry well should be of such capacity to receive this entire flow. If the flow is such, that the size of the dry well would be enormous, then it is recommended that an additional dry well be considered for the purpose of maintaining moderate sizes.

The water in the dry well will drain into the earth at a rate dependent upon the drainage qualities of the soil. In sand or gravel the rate of drainage is rapid. In other soil which is not as porous, the rate of drainage is somewhat reduced. Often, when tight soil conditions exist, the dry well is increased slightly in size to compensate for the additional number of hours required for drainage. It is good practice, when the drainage rate of the soil must be known, to make a percolation test. If the soil is so tight that drainage is almost impossible, then dry wells or other similar means of disposal may not be used to their best advantage. In this case the rainwater must be disposed of in another manner. Often, test borings are made in an effort to locate soil that is more porous, into which the water may then be disposed, by means of deep drainage pipes. However, in this article we are concerned only with normal soil conditions.

Construction Details

Dry wells may be constructed of cement block, brick, stone and other material so laid with open joints that the water can freely drain into the earth. Also available are various types of pre-cast concrete dry wells with holes or slots for drainage. Regardless of the materials used, it is of prime importance that the dry well be carefully constructed to withstand normal, structural and surface loads and to provide maximum efficiency. Since a dry well will be in operation for a good number of years, and because

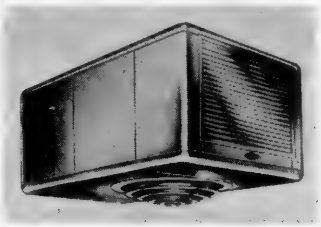
(*Concluded on page* 141)

NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite page 116 for securing additional information on items described here.

Ceiling Type Air Conditioner

A ceiling-suspended air conditioner is introduced by Union Asbestos & Rubber Co., Chicago, Ill. Novel features incorporated in the air conditioner for industrial, commercial and store use include a built-in winch which permits two men to easily and economically install the unit within a few hours, without the need for expensive rigging.



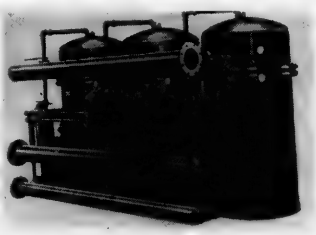
At the same time this Unarco unit can be serviced by one man, if it becomes necessary, by means of the same winch which permits lowering of the entire one-piece power unit.

The unit comes in sizes ranging from three to seven and one-half tons. It is equipped with a condensate pump, making it unnecessary to run drain pipes from the bottom of the unit. All piping and electrical connections are brought down from the ceiling or can be run over from the wall.

More information? Enter Item 1 on postcard, page 116

Swimming Pool Filters

A new Diatomite filter, designed and built expressly for maintaining clear, blue water in swimming pools of all sizes and degrees of bather load, is a new product of R. P. Adams Co., Inc., Buffalo, N. Y. The new Model SPF filter is built around the Poro-Stone principle of filtration, with filter aid application and built-in back wash.



In operation, after the Poro-Stone filters have been precoated, the pool water inlet valve is opened and filtration continued until the gages show a pressure drop of 25 to 30 pounds when, by simply turning valves, the filter is backwashed in a few seconds, ready for another filtration cycle.

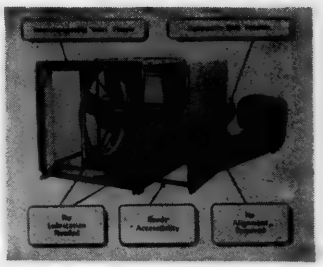
On large pools where more than one filter is required, any one of the filters may be precoated or backwashed while the balance of the filters are in filtration service. Due to the large area of filter surface obtained with tube type elements, the useful filtering period between cleanings has been greatly increased.

Units are available for any size pool. Illustration shows a battery of three filters.

More information? Enter Item 2 on postcard, page 116

Improved Draft Inducer

A new design of its furnace draft inducer, originally introduced in the 1920's, is announced by L. J. Wing Mfg. Co., Linden, N. J. Main features of the new design include interchangeable side panels, movable mounting feet, motor and fan assembly completely withdrawable, spring-mounted motor and V-belt drive to prevent misalignment, variable speed motor for precise draft control and pre-sealed bearings to eliminate periodic lubrication.



The unique feature of the inducer, the interchangeable side panels, permits easy adaptation in the field to meet installation requirements for gas inlet and outlet openings. The four side panels surrounding the motor-fan unit may be unbolted and shifted as desired. A barometric damper may be used replacing one of the side panels. Moveable mounting feet allow for four different mounting positions.

As the unit is compact, it can be easily manipulated in the often limited space at the stack breeching, especially since only the casing need be handled. The motor-fan assembly may be inserted as a final step.

The inducer has a wide capacity range to loads of 100,000 lb per hour.

More information? Enter Item 3 on postcard, page 116

Automatic Coal Stoker

A new Binfed-Ramfeed stoker of the package unit type is announced by Canton Stoker Corp., Canton, Ohio. This is a unitized design which incorporates the Flo-Tube conveyor, with the Ramfeed stoker of either the Vulcan or LoSet types, into a combination unit.

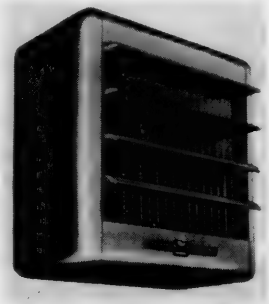
This model conveys the coal direct from the coal storage to the furnace without manual attention. The stoker is stated to be dust free, and when equipped with bin level controls, will automatically start when the hopper is empty and stop when the hopper is full. The flow of coal to the furnace is pro-rated by automatic controls according to the steam demand, and the only attention necessary is the removal of ashes once or twice a day. The stoker can be equipped with ash quenching pipes, which help to eliminate dust in ash-removal.

Very little power is required, and the unit can be installed from the front, side, or rear of the boiler, depending on the location of the coal bin. Combinations of horizontal and inclined conveyors can also be supplied where two or more hoppers are to be supplied with fuel.

More information? Enter Item 4 on postcard, page 116

High Pressure Unit Heaters

A new series of horizontal unit heaters designed to provide comfortable outlet temperatures on high pressure, high temperature steam systems is added to its Herman Nelson unit heater line by American Air Filter Co., Louisville, Ky.



The new unit's low outlet temperatures at the standard 2 psig rating make them suitable for comfort heating jobs where high temperature, high pressure steam is used. The new propeller fan unit heaters can be used on steam systems of pressures up to 125 psig. Capacity range is 385 to 5430 cfm (70 deg air), 17,400 to 228,000 Btu per hr (with 60 deg entering air and 2 psi steam pressure). The units are also suitable without modification, for forced hot water heating systems. The unit heaters in the new series are available with single or two speed motors. All motors are completely enclosed. The unit casings feature horizontal directional louvers with vertical deflection louvers available as an accessory.

More information? Enter Item 5 on postcard, page 116

Refrigerants in Two Types

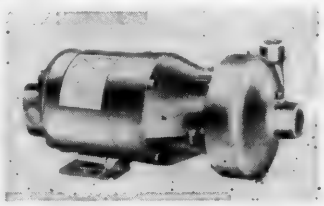
A new line of refrigerants is being marketed by General Chemical Division, Allied Chemical & Dye Corp., New York, N. Y., under the trade name Genetron.

Two types are available—Genetron White Label—12 (dichlorodifluoromethane) and Orange Label—11 (trichloromonofluoromethane). The former is available in 10, 25, 145 and 2,000 lb. cylinders, the latter in 100 and 200 lb. drums and 2,000 lb. cylinders.

More information? Enter Item 6 on postcard, page 116

Water Pressure Boosters

In many areas throughout the country, water pumping stations are often unable to accommodate all new construction and the additional requirements of modern water consuming equipment. While plenty of water may be available, the pressures developed by existing pumping stations may be inadequate because of extended water mains and increased water demand.

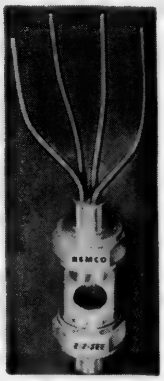


To aid the situation, Bell & Gossett Co., Morton Grove, Ill., offers a low cost pressure booster. Available in many sizes, the pressure booster is a centrifugal pump of corrosion-resistant bronze construction. It is small and compact and utilizes a special sleeve bearing motor for extra quiet operation. The pump can be installed directly in the lead-in pipe from the water main and is operated automatically by a switch which detects changes in water pressure. When the city water pressure drops below a minimum setting, the switch starts the pump to increase the water pressure.

More information? Enter Item 7 on postcard, page 116

Liquid Indicator-Distributor

A means of checking the quality of the liquid refrigerant entering capillary tubes is provided by a combination liquid indicator-distributor marketed by Remco, Inc., Zelienople, Pa. It is claimed that a liquid indicator reduces production costs by reducing run-in time, since slight underchanges of refrigerant are readily detectable by the presence of bubbles in the liquid indicator. This is especially important in all types of air conditioning systems where a frost line does not exist.



Both the liquid line connection and the distributor connection are of the swivel or union type. Due to this arrangement, the liquid line and cap tube or tubes may be soldered (soft or silver) to their respective connections while completely removed from the hermetically sealed body and glass assembly. They subsequently are attached to the body assembly with large hex union nuts.

More information? Enter item 8 on postcard, page 116

Acoustical Ceiling Diffuser

A new Multi-Vent panel, especially designed for air diffusing in the Celotex Acousti-Line ceiling, is announced by The Pyle-National Co., Chicago, Ill. This new air diffuser, called the Linear Multi-Vent panel, for heating, cooling and ventilating, provides advantages which were formerly possible only with a metal pan acoustical ceiling.

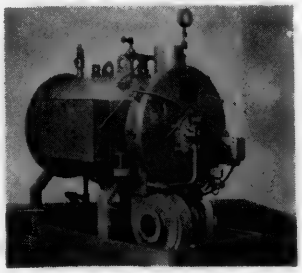
Use of the flush perforated Acousti-Line panel as a diffusing plate eliminates all protruding air outlets and unsightly grilles. It permits complete freedom of interior design and decoration with new overhead beauty. The low velocity air delivery eliminates the dirtying or discoloration of adjacent acoustical blocks, often a costly maintenance problem.

The flexible, compressible tubing supplied with the panels for use with duct air supply, radically reduces installation cost by eliminating all need for time consuming, close-fitting sheet metal work. This also permits the economy of shop built duct work which can be installed prior to and independent of the ceiling suspension allowing the sheet metal contractor to attach the panels and balance the system before the ceiling contractor comes on the job.

More information? Enter Item 9 on postcard, page 116

Small Size Packaged Boiler

A new line of pocket-size automatic package boiler units is announced by Ames Iron Works, Inc., Oswego, N. Y. The small dimensions and self-contained design answer the demand for an automatic source of steam or hot water for small shops, laundries, dry cleaners, dairies, bottlers, meat packers and other operations requiring the smaller capacities.



Called the Model TP steam generator, it is available in seven sizes from 15 to 60 hp (15 to 200 psi working pressure), for firing with light oil, gas or light oil, gas or light oil-gas combination. Model TP is fully piped and wired and needs only to be connected to the customer's service lines and to his breeching or stack. The small size with 71-inch overall length, 35-inch base width and 54-inch height, facilitates installation in smaller places than heretofore possible. The new units also provide unusual flexibility for any user of steam, permitting later addition of units should capacity requirements increase.

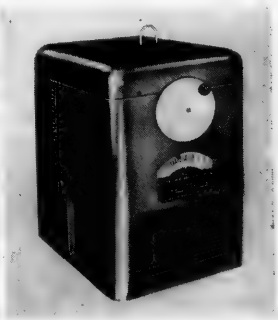
Bulletin No. TP-1 is available.

More information? Enter Item 10 on postcard, page 116

Welder Has Wide Current Range

A new a-c welder is announced by The Lincoln Electric Co., Cleveland, Ohio. The new welder is designed for operation on a wide range of light and heavy welding with modern, efficient electrodes.

Called the Fleetwelder Special, the welder provides exceptionally wide current range with generous reserve for heavy, sustained welding at high currents. The design incorporates separate power and control circuits with an adjustable rotary type reactor control and liberal use of steel and copper. Thus, welding can be done on both sheet metal and heavy plates with one machine.



The reactor control is separate from the main transformer and is designed for high responsiveness to arc conditions. The holding mechanism is independent of the adjusting mechanism, preventing jerks in the control mechanism and needs no maintenance or lubrication. The unit has a double reduction gear drive with ball bearing shaft construction. The current setting is indicated by a pointer as well as by an indirect light beam behind the transparent plastic graduated scale. The windings are of heavy copper with spun glass, refined asbestos and mica insulation. Coil separators are mica. The frame and housing are of welded construction.

Bulletin 1344 is available

More information? Enter Item 11 on postcard, page 116

Excavator for Pipe Lines

The Deluxe Pippin excavator is being distributed by Pippin Construction Equipment, Inc., White River Junction, Vt. It is useful to plumbing contractors for water and gas lines, sewer systems, septic tanks and drainage tile, digging up pipe lines.

The excavator digs to depth of over 10 ft and has a 120 deg arc swing which permits a great deal of backfilling from one tractor position. A quick changeover from back hoe to shovel to backfill blade makes the machine a three in one device with almost unlimited uses.

More Information? Enter Item 12 on postcard, page 116

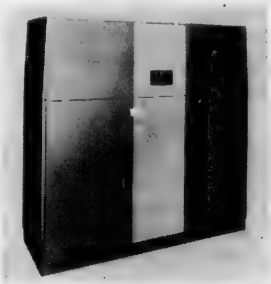
Glass Fiber Filter

A new, improved type of replaceable glass fiber filter for residential and commercial warm and cool air conditioning equipment, is announced by Filtrex Corp., Corona, N. Y. This newly-formed company has developed a process which makes glass fiber soft and pliable, eliminating the danger of glass slivers, and preventing minute splinters of glass from breaking off the filter pack and circulating through the air stream. The fibers are separated and arranged in graded densities to provide dust arrestance throughout the depth of the filter. Surface loading is thereby eliminated and the filter can maintain a maximum flow of air even when heavily loaded with dust particles, so that high filter efficiency is maintained over extended periods of time.

More Information? Enter Item 13 on postcard, page 116

10 Hp. Heat Pump Unit

The largest packaged air-source heat pump on the market is announced by General Electric Co. Weathertron Dept., Bloomfield, N. J. The new Weathertron, designed for larger homes and commercial buildings, is powered by two modulated 5 hp compressors and will handle up to 3,000 cfm. It features a completely sealed hermetic refrigeration system warranted for five years.



The decision to broaden the line with this new model was reached when marketing research figures revealed a trend toward a heavy demand for larger units. Additional models are to be added as the continuing marketing research program dictates. The new unit, designated the 98B, will supplement the present line of 3 and 5 hp models.

More Information? Enter Item 14 on postcard, page 116

Volume Water Heaters

Extension of its WH series line of tankless twin coil volume water heaters is announced by Portmar Boiler Co., Inc., Brooklyn, N. Y. It is stated that the line can now automatically supply large quantities of instantaneous, sanitary hot water through copper coils, without a storage tank, for practically every size and type of building: residences, apartment houses, motels, restaurants, automatic laundries, hotels, hospitals, office buildings, luncheonettes, schools, gymnasiums, factories, and processing plants.

Fired with oil or gas and built to ASME Boiler Code specifications, these self-contained water heaters are available in 9 sizes, with larger sizes built on request, delivering hot water from 300 to 5,000 gph. The submerged twin coils are connected adjacent to each other and submerged horizontally across the top section of the heater, where the hottest water is contained. One coil performs as a preheater, permitting complete hot water circulation through the coils. The twin coils being completely surrounded by fast circulation hot water, accomplishes quick temperature pickup and requires no recovery time.

The heater's ability to meet high, instantaneous hot water requirements results from 227 deg temperatures maintained in the water heater which acts as a storage reserve, increasing heating capacities 100 per cent. When two temperatures of evenly tempered hot water are required, 140 deg for general use and 180 deg sterilizer-rinse for dishes, both can be supplied from the same water heater.

More information? Enter Item 15 on postcard, page 116

Casement Window Room Coolers

The Victor ¾ ton casement-type air conditioner, custom-built to fit a standard three light opening casement window, is announced by Amstan Supply Division, American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

A push-button control panel provides six selections of temperature. Cool air is filtered to remove dust, dirt and pollen and is dehumidified. A no-draft, 3-dimensional feature sends cool air to all corners of the room for comfortable and natural circulation. Room air is completely changed up to five times an hour, permitting an automatic and constant flow of fresh, filtered air into the room.

The unit can be operated on a normal 115-volt, single phase, 60-cycle circuit. It cools up to 500 sq ft of space and requires no pipes, drains or water for operation. It is mounted from the inside.

More information? Enter Item 16 on postcard, page 116

New Electric Motor Line

A new line of AC, squirrel cage, induction electric motors is announced by Delco Products Div., General Motors Corp., Dayton, Ohio.

The new motors, in frame sizes from 182 through 326, have been manufactured to meet the new NEMA standards on re-rated frame sizes and represent a major stride in electric motor design with less waste space, lower noise level, less weight and better appearance.

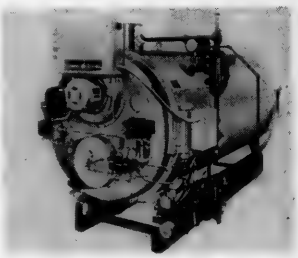
One of the newly designed Delco motors is the open drip proof motor (illustrated) which features cast iron main and end frames, aluminum die cast rotors, grease lubricated double shielded ball bearings, the Delcote cotton and varnish insulation, and a drip proof baffle cast as part of the end frame which protects the motor from dripping liquids.

Another of the new motors is the totally enclosed fan cooled motor. This motor is built with sturdy ribbed frame construction which allows the external fan to direct air efficiently over the smooth ribbed frame. Cooler operating temperatures are obtained with the new design and cleaning problems are negligible.

More information? Enter Item 17 on postcard, page 116

Boiler Line Expanded

Extension of its CB line of boilers to include units of 50, 60, 70 and 80 boiler horsepower capacity is announced by Cleaver-Brooks Co., Milwaukee, Wis. These self-contained boilers are available for commercial, industrial and institutional installations requiring steam or hot water boilers for processing or heating.



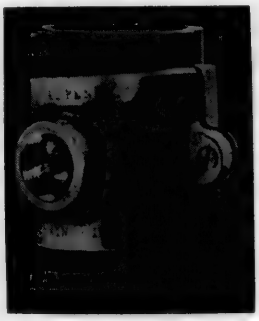
Among the major features providing boiler performance never before available are silent operation, with low decible ratings which makes the unit ideal for schools, hospitals or institutions where sound levels are critical; full modulating burner in models available to handle all grades of fuel oil, light distillate No. 2 to 6 or Bunker C; more efficient oil pre-heating equipment attached to the boiler base frame; a new silent oil pump using a gear head motor which eliminates pump operational noise, and Fireye electric combustion safety control.

The boiler has maximum accessibility for operation and maintenance with easy-to-open hinged doors on front and rear of unit. It burns gas or oil at maximum efficiencies and can be converted from one fuel to another in less than a minute.

More information? Enter Item 18 on postcard, page 116

Saddles for Plastic Pipe

The Rain-Rite Tap-In Saddle for flexible plastic pipe is being distributed by Heatrite Corp., Culver City, Calif. These saddle type fittings are intended for sprinkler irrigation systems and water distribution systems where plastic pipe is used. The saddles are full flow fittings and leak-proof at all pressures without using clamps or sealing compounds. They can be used as tees for laterals, as a cross, or as a tee for risers, leaving the main line unrestricted.



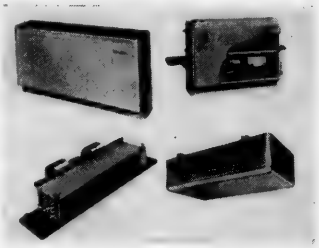
The two halves of the cast brass saddle are fastened together with brass screws and nuts. They have a machine-ground seat in the outlet that retains the tap-in sealing device and its hard fiber washer, to form a pressure seal in both open and closed systems.

Installation requires no cutting of plastic pipe and eliminates the worry of pipe separations at risers or laterals from pressure surges or pipe contraction. These saddles are made in the following pipe sizes: ¾ x ½, 1 x ½, 1 x ¾, 1½ x ½, 1½ x ¾, 2 x ½, and 2 x ¾ inch.

More information? Enter Item 19 on postcard, page 116

New Line of Air Conditioners

Four air conditioner types designed for operation with new or existing hot water heating systems are being marketed by The Modine Mfg. Co., Racine, Wis. The newest models in the line are the Overhead and DeLuxe Ceiling Types. The Console and the Concealed models complete the line. All of the types heat, cool, ventilate, filter, dehumidify and circulate room air and fresh air in individual rooms and provide maximum service where requirements for these operations are high. The new line, called Airditioners, is suited for hotels, offices, apartments, motels, hospitals and similar multi-room applications. The units eliminate the high cost of installing insulated central duct systems in new buildings.



The Overhead Type (OH) (lower left), is designed for concealed installation and can be mounted in a drop ceiling, a similar furred space or in a closet. Conditioned air is discharged from the unit into a transition duct connected to an outlet grille in the wall or ceiling. Integrally stamped or adjustable louver grilles are optional.

The DeLuxe Ceiling Type (CL) (lower right) is designed for exposed installation, particularly in buildings where structural alterations such as would be required for concealment or recessing of an air conditioning unit are to be avoided.

The Console Type (CS) (upper left), is equally suitable for fully exposed or recessed installation. For exposed installations, the cabinet is placed flush against the finished wall. A ⅝-inch thick sponge-rubber strip around the entire perimeter of the enclosure back serves as a wall seal and as a plenum for the fresh air inlet. Piping and wiring are completely concealed within the enclosure.

For out-of-sight, built-in installations, the line includes the Concealed (CC) Type (upper right). The unit can be installed in a vertical or upright position, in an outside wall under a window sill and behind a finished wall panel.

Each type is available in three sizes with ⅔, 1½ and 2-ton capacities. The units are powered by 1/30, 1/15 and 1/12 hp motors, respectively. The blower platform is 14 gage steel, with ends of the blower housing of 18 gage steel. Other sheet metal, including optional plenum, is 20 gage steel. All surfaces are treated before spraying for protection against corrosion and marred surfaces.

More information? Enter Item 20 on postcard, page 116

Convector-Radiators

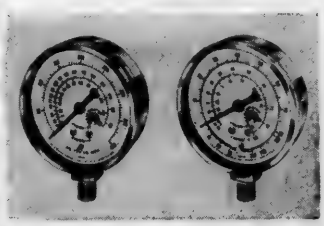
Convector-radiators with new slide-in front panels are announced by Heating Division, Fedders-Quigan Corp., Trenton, N. J. The new slide-in front panels are available on Type F, FE and FB convector-radiators. In addition to cutting installation time from minutes to seconds, the slide-in panels present smooth surfaces without screws to mar the overall effect or chip the finish.

This slide-in feature eliminates drilling, hand fitting and screw driving.

More information? Enter Item 21 on postcard, page 116

Freon Test Gage Set

A new de luxe serviceman testing gage set has been developed by Jas. P. Marsh Corp., Skokie, Ill. It was designed for use by refrigeration servicemen in making tests on Freon refrigeration systems.



The set consists of two 2½-inch dial size gages; one graduated 0-400 lb. (left) and the other, a compound retard gage, graduated 30 inches by 250 lb. (right). Dials on both the pressure gage and the compound retard gage are provided with corresponding temperature scales for Freon-12 and Freon-22.

Both gages are carefully calibrated and have a guaranteed accuracy of plus or minus 1% over the entire range. Clear, sharp dial markings and fine line pointer assure easy, accurate reading.

More information? Enter Item 22 on postcard, page 116

Wall Line Convector, 3 Heights

A wall line convector, designed specifically for modern institutional and industrial buildings with bands of windows, has been developed by The Trane Co., La Crosse, Wis. The new units are available in 14, 20, and 26-inch heights, and in lengths ranging from 2 to 6 feet in increments of 4 inches. Cabinet depths are 4 inches and 6 inches.

Cabinets with sloping tops enclose a high capacity heating element of seamless copper tubing with mechanically bonded aluminum fins. Each cabinet locks into the adjoining one to form a continuous heating unit. Measurements to obtain proper pitch of the heating element are eliminated by a screw adjustment fastened to the element support bracket.

Corner cabinets are available to permit continuous installation on two walls. End caps permit a finished appearance when units are not installed along the entire length of the wall.

More information? Enter Item 23 on postcard, page 116

Packaged Air Conditioner

Creation of a commercial and residential packaged air conditioning division to manufacture larger size units ranging from 2 to 15 hp is announced by Mitchell Mfg. Co., Chicago, Ill.

Improved Oil Level Indicator

A relatively inexpensive, accurate and improved dial type oil level indicator is developed by Liquidvision Gauge & Control Corp., Oceanside, N. Y. The indicator is designed for use on oil storage tanks.

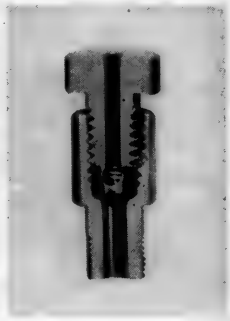
The gauge, which is known as the Model I, is equally adaptable to any liquid wherever a remote reading hydrostatic tank gage is required. It is equipped with a combination Plexiglas dial and lens cover which features an external zero adjustment. The manufacturer states that the graduations are very distinct and can be read at a glance. For installation, all that is required within the tank is an airbell that is supplied with the gage and a length of copper tubing to connect the indicator head to the airbell. Also furnished with the airbell is a tank bushing and compression fitting to seal the vapor in the top of the tank.

Bulletin No. 115 is available.

More information? Enter Item 24 on postcard, page 116

Manual Bleeder Valve

A manual bleeder valve, designed to release unwanted fluids and gases from radiators, power cylinders, small air tanks, diaphragm spring chambers, differential valves and pilot lines, is being marketed by A. W. Cash Co., Decatur, Ill.



This mechanism has such features as a self-contained beveled seat, positive tight closure, nonclogging stem port, self cleaning passages, extra large capacity, and an adjustable knurled control knob. Special tools are not required to install or operate them.

These valves are regularly supplied in brass or stainless steel in ⅛-inch standard iron pipe thread size for most fluids or gases. Special construction materials are available on request.

More information? Enter Item 25 on postcard, page 116

Drafting Templates for Valves

Drafting templates for drawing all types of standard and special duty valves are being marketed by Graphic Indicator Co., Los Angeles, Calif. The templates are made to scale for industrial and commercial pipe-line drawings.

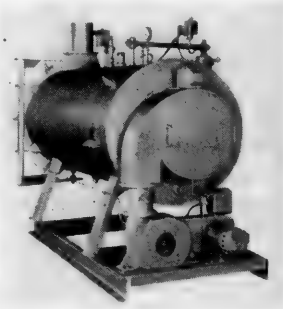
The templates are designated Small Valve Indicator No. 255 and Large Valve Indicator No. 257, and are used for ⅛, ¼, and ½-inch scale, for indication of drawn-to-scale pictures of any type valve, with variable pipe connections.

The actual size of the templates is 5⅜ by 9⅞ inches. They are made of rigid Vinylite that stays flat with nonglare and non-slip surface.

More information? Enter Item 26 on postcard, page 116

Small Steam Generator

To meet the need for a low cost steam generator for small commercial applications, York-Shipley, Inc., York, Pa., has developed the Steam-Pakette in sizes ranging from 15 to 30 hp for high-pressure steam application. It can be used with light (No. 3) fuel oil, gas or combination firing of either oil or gas. The change-over from one fuel to the other on the combination firing models is accomplished by throwing a single switch.

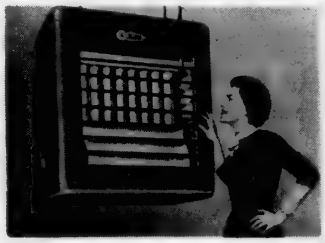


The units are designed for high pressure duty with a maximum design pressure of 125 lb. The unit is small in physical size with an over-all width of 40 inches, height of 58⅝ inches, and length of 85⅜ inches. Units are delivered fully wired to the control panel, requiring only a minimum of on-the-job wiring.

More information? Enter Item 27 on postcard, page 116

Small Oil Unit Heaters

Ten additional smaller sizes to complete its line of these unit heaters using a conventional gun-type oil burner, are announced by Delta Heating Corp., Trenton, N. J. The largest size, Model UH220, has an output of 200,000 Btu per hr, equivalent to 900 square feet of steam radiation.



In addition, these oil-fired unit heaters are now available with output ratings ranging from 196,000 to as low as 112,000 Btu per hr.

A complete selection is offered with varying outlet air temperatures and noise levels to suit the particular installation, and for process and special heat applications. The heaters will operate with drafts as low as .01 inch and are provided with adjustable louvers to control the direction of the heated air. The high velocity type propeller fan will throw air from 37 ft for the smaller size, up to 75 ft for the largest size.

More information? Enter Item 28 on postcard, page 116

Corrosion Inhibitor

An addition to its line of volatile corrosion inhibitors, VPI-250, is announced by Shell Oil Co., New York, N. Y. Portions of this crystalline amine nitrite compound volatilize very rapidly and will prevent rust almost immediately. At the same time, some of its constituents evaporate more slowly, for longer-lasting protection. The new material also flows more freely than any available heretofore.

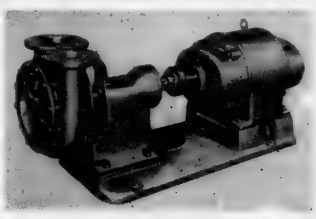
The material does not have to be applied directly to the surface it is to protect. If a quantity of the powder is simply dropped into an enclosed space, its vapors will penetrate even into hard-to-reach areas and condense on all surfaces. Also the minute crystalline film does not have to be removed from equipment before it is placed into operation, as would be the case with grease or petrolatum.

The material has been effective in preventing corrosion under high humidity in engines, compressors, pumps, sheet metal components and a wide variety of similar applications.

More information? Enter Item 29 on postcard, page 116

Pump for Corrosives, Slurries

A new line of centrifugal pumps designed especially for handling corrosive liquids and slurries is announced by Goulds Pumps, Inc., Seneca Falls, N. Y.



The new pumps, designated as the Fig. 3715 series, embody a number of improvements over earlier similar pumps. They are available with the entire fluid end in three types of stainless steels, all iron, all bronze, bronze fitted, all iron with stainless trim, or all bronze with stainless trim.

The pump is built in nine sizes, ranging from ¾-inch to 3 inches, providing capacities up to 720 gpm, and heads to 200 feet.

Bulletin 725.4 is available.

More information? Enter Item 30 on postcard, page 116

Tropical Air Conditioners

The adaption of 27 five-ton highboy units for use in tropical climes is announced by the Heating and Cooling Div., Union Asbestos & Rubber Co., Chicago, Ill. The units have extra cooling and dehumidification capacity as well as fungus and moisture-proof controls.

Several changes are incorporated in the units which differ drastically from standard production models. Open type compressors are used rather than conventional hermetically-sealed units, to enable field replacement in the event of motor trouble. A coating is applied to all controls to make them moisture-proof and inhibit fungus growth. A reheat water coil is installed in the space which would normally be used for a heating unit, due to the necessity of increasing the dehumidification capacity. To avoid the unsatisfactory moisture removal which would result from standard air conditioners under tropical conditions, an automatic valve is installed in the leaving water line so that warm water from the condenser can be recirculated through the reheat coil, adding heat to the leaving air.

Through the use of automatic valves and switches, the air can be kept to fairly close tolerances in temperature and humidity. The units will supply 70,000 Btu per hr cooling capacity at a temperature of 80 deg, and 50% relative humidity.

More information? Enter Item 31 on postcard, page 116

Purge Valve for Baseboards

Equa-Valve, a new type of purging and venting assembly for use with a two or more circuit hot water baseboard heating system, is being marketed by Hi-Flow Products, Inc., Baltimore, Md. It enables the heating contractor quickly and completely to purge all air from the lines when starting the heating system. It also permits the proper balancing of flow through the several circuits of the system without the use of added gate valves, tees or nipples, thus saving both time and material by its use.

More information? Enter Item 32 on postcard, page 116

Seal Balanced Angle Valves

Balanced control at high pressure differentials with tight shutoff is achieved with the Seal-Balanced angle valves announced by Hammel-Dahl Co., Providence, R. I.

These valves embody corrosion resistant retained seat ring, reduced turbulence, Venturi throat design, large flow capacity, and, in addition, eliminate the plug unbalance usually associated with single seated valves.

The force caused by line pressure working against the cross sectional area of the plug is cancelled out by means of a drilled hole along the axis of the plug, intersecting radially drilled holes near the top. Thus, the line pressure is transmitted through this passage and exerts a downward force on the plug equal to the upward force. As a result the valve may be positioned accurately at pressure differentials as high as 3600 psi with standard superstructures actuated by standard instrument air output.

The valves are manufactured in sizes from 1 to 8 inches, with body ratings from 150 to 1500 lb. ASA Standard at a temperature rating of 450 deg.

More information? Enter Item 33 on postcard, page 116

Tests For Leaks in Piping

The Test-King for pressure testing and locating leakage in water lines, radiant heating systems, and general piping is being manufactured by General Air Products Corp., Chicago, Ill. One charged unit can be used to test approximately 10 average size homes. Leaks are distinctly audible and visible due to frosting of atmospheric moisture. The equipment comes complete with pressure gage, valves, fully charged and ready for operation.

Refills are obtainable at any carbon dioxide fire extinguisher refill station or from the manufacturer.

More information? Enter Item 34 on postcard, page 116

Transformers for 230-Volt Units

Installation of air conditioning equipment in offices and commercial buildings has often brought about electrical service problems that can be met by the new line of Boost and Buck transformers announced by Acme Electric Corp., Cuba, N. Y.

Many installations of air conditioning equipment are made in locations where only 115 volts AC is available, and since the motor driving the larger air conditioning compressor units requires 230 volts, a special circuit must be connected to two legs of a power line. Tapping two legs of a power line provides 208 volts single phase. This 208 voltage, not being sufficient to develop full starting torque of the 230 volt single phase compressor motor, may result in the motor failing to come up to normal speed and torque, causing unsatisfactory performance of the air conditioning unit, overheating and possible burnout of the motor.

The purpose of the line of Boost and Buck transformers is to increase the 208 voltage closely to parallel the requirements of the 230 volt motor thus providing the electrical characteristics necessary for top performance.

The series of transformers are essentially 4 winding insulated transformers in which the separate windings are inter-connected so as to provide essentially the same voltage tapping characteristics as an auto transformer. In effect the secondary winding voltage is added to the input voltage thus boosting the output voltage 5% to 10% as desired. In addition, the load capacity of the transformer is compounded in relation to its multiplied output voltage. Thus a ¼-kva transformer of 120 x 240 volt input and 12 x 24 output, by interconnection becomes a transformer suitable for use on a 208 volt circuit and delivering 228.8 volts with a load capacity of 2.38 kva.

Bulletin BB-199 has been prepared.

More information? Enter Item 35 on postcard, page 116

Heavy Duty Trencher

A new heavy-duty trenching machine for pipelines and similar heavy construction jobs, Model 240, is introduced by The Cleveland Trencher Co., Cleveland, Ohio. It is a full-crawler-mounted, wheel-type trencher which digs up to 36 inches wide and down to 6 feet 3 inches deep.

The trencher has a low ground bearing pressure of 6.3 lbs per sq inch which is outstandingly effective because the machine is balanced perfectly at the center of its non-packing crawlers which are 100% anti-friction bearing equipped. This enables the trencher to work effectively in the wettest rights-of-way and overcome the toughest hills.

The digging wheel employs a front upper truck as well as a rear upper truck. This additional truck, mounted on self-alligning bearings, supports the digging wheel entirely independent of the driving sprockets, providing smooth, power-conserving digging action and adding life to segments sprockets and shafts.

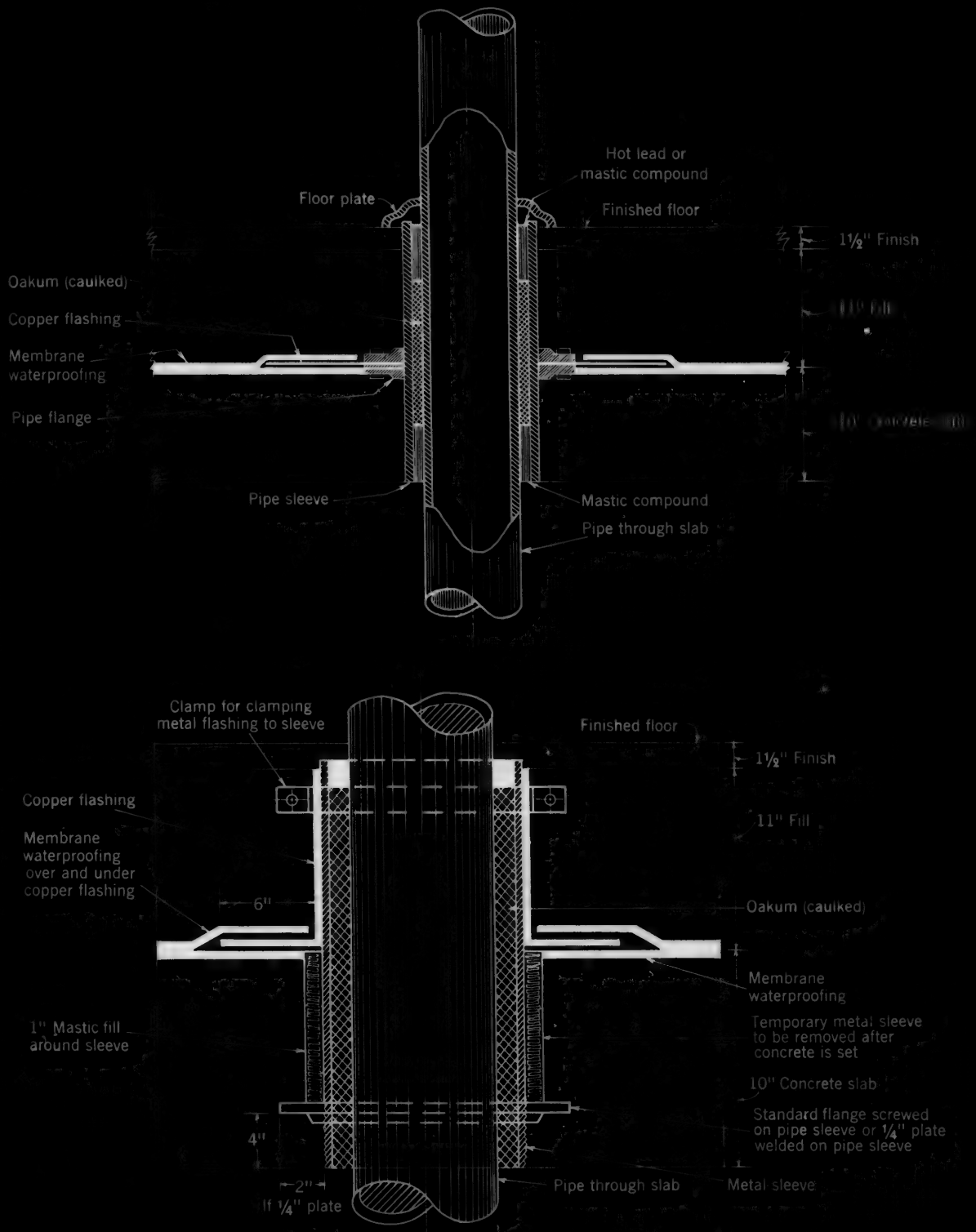
Another feature is a new crawler kick-out clutch. It permits stopping the crawlers without halting the digging wheel's operation — gets more production in tough digging.

Three optional bucket sizes give the machine a trench width range from 20 to 36 inches. Maximum trench depth is 6 feet, 3 inches. The 30-inch wide reversible conveyor discharges spoil on either side of trench. Over-all length is 24½ feet and road width is 8 feet. It is powered by a 460 cubic inch diesel engine delivering 65 hp at 1,200 rpm.

More information? Enter Item 36 on postcard, page 116

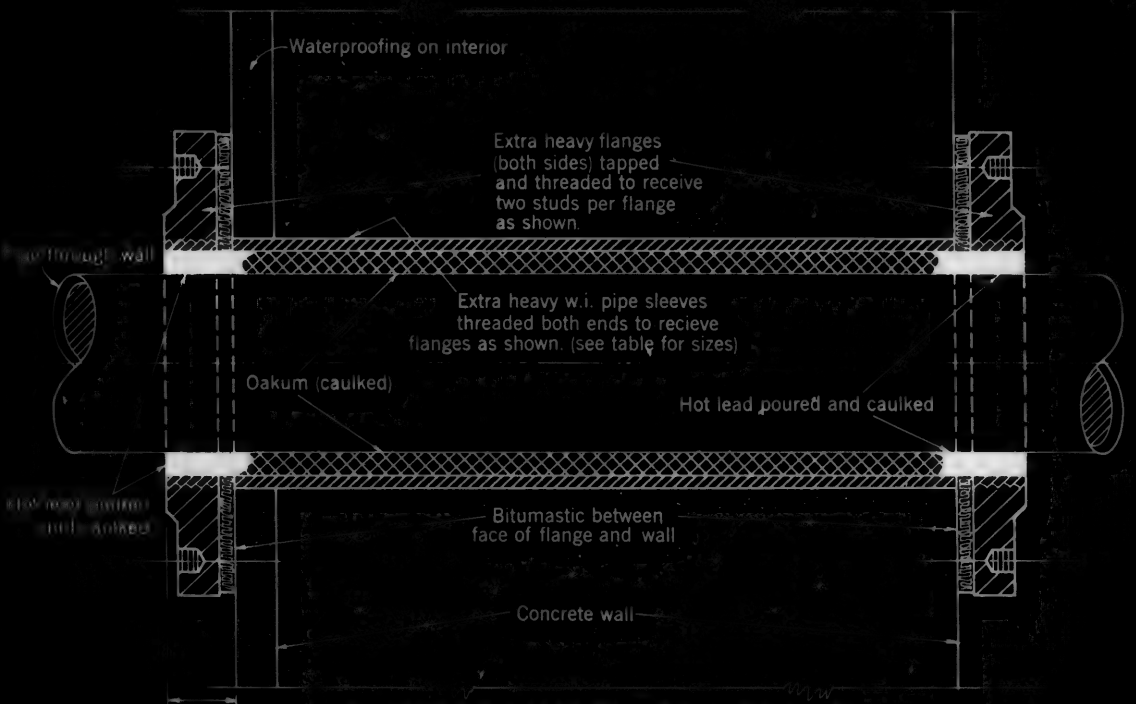
(*Continued on page* 110)

PIPES THROUGH WATERPROOFED FLOORS

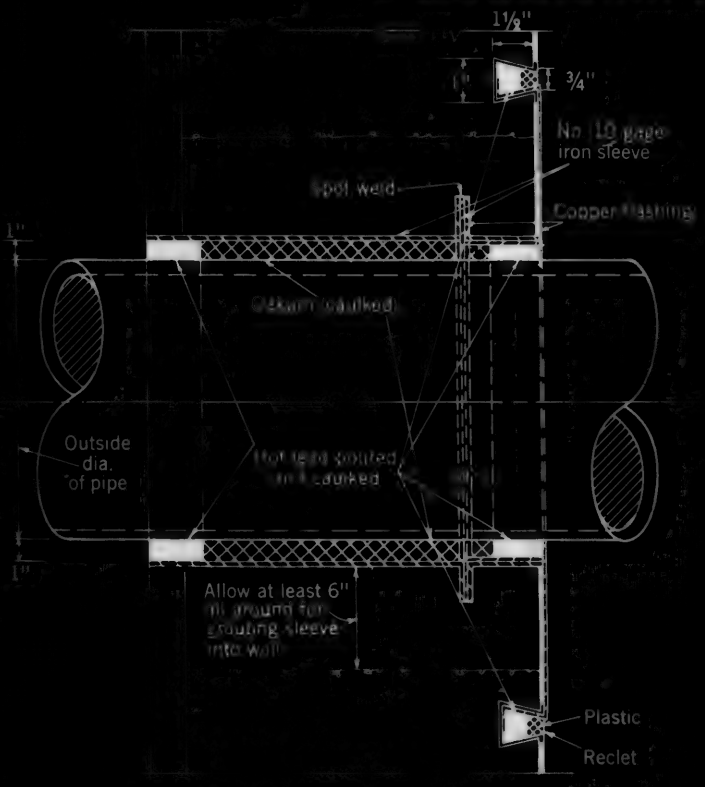


1 AND 2 - SLEEVE DETAIL FOR PIPE THROUGH WATERPROOFED FLOORS

PIPES THROUGH WATERPROOFED WALLS


Waterproofing on interior
Extra heavy flanges (both sides) tapped and threaded to receive two studs per flange as shown.
Extra heavy w.i. pipe sleeves threaded both ends to recieve flanges as shown. (see table for sizes)
Oakum (caulked)
Hot lead poured and caulked
Bituminous between face of flange and wall
Concrete wall
Size varies

3 - SLEEVE DETAIL FOR PIPES 8" DIA. AND SMALLER



4 - SLEEVE DETAILS FOR PIPES OVER 8" DIA.

SLEEVE DIAMETER FOR PIPE 8" AND SMALLER	
Dia. of pipe through wall inches	Dia. of required sleeve inches
½	3
¾	3
1	3
1¼	4
1½	4
2	5
2½	5
3	6
4	6
5	8
6	8
8	10

DETAIL [illegible] - AND 4 [illegible] MANUAL [illegible]

"OVER 10,000 Satisfied Maryland Home Owners Attest to the Outstanding Qualities of REVERE COPPER WATER TUBE—"

Says, Anthony W. Keene, President, ANTHONY W. KEENE, INC., Heating & Plumbing Contractors, Baltimore, Md.

"I've been operating in the Baltimore area for over eighteen years," said Mr. Keene. "Typical of the 10,000 units in which I have installed Revere Copper Water Tube is the Meadow Lane development which you see on the wall of my office. I have worked with various builders and they have told me they wouldn't specify anything but enduring copper water tube for plumbing lines . . . no rustable materials for them. Not only that; copper is easy to bend, needs no threaded fittings so naturally we can hold down our installation costs. Ever since I have been in business I have used Revere Copper Water Tube and have never regretted one foot of it."

Keep out of trouble with copper . . . guard *your* reputation for quality work. Use enduring Revere Copper Water Tube. There's a Revere Distributor near you who carries a full stock in both hard and soft tempers. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

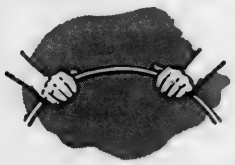
• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

WHY REVERE COPPER WATER TUBE IS PREFERRED BY—

Architects, Builders, Plumbing & Heating Contractors



EASY TO BEND

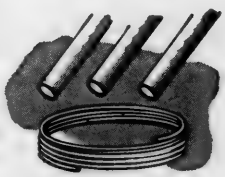
Saves Time

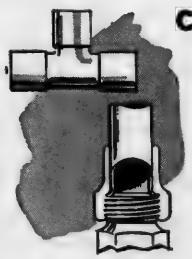
Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions.

HANDY LENGTHS

Save Fittings . . . Labor

Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.





SOLDER OR COMPRESSION FITTINGS

Need Less Work Room . . . Save Metal

No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.

(*Continued from page* 106)

One-Piece Low Cost Filter Gage

A one-piece filter gage for forced air heating, cooling, and ventilating units has been introduced by Bacharah Industrial Instrument Co., Pittsburgh, Pa. This gage determines the filter's resistance to free passage of filtered air as well as its capacity to clean the air, and automatically indicates when the filter has become dirty and should be replaced.

The gage can be mounted by drilling four ¼-inch holes through the wall of the blower chamber, then pressing a pronged hook on the instrument's back through two of the holes. The gage does not require a connection across the filter, and it uses no electric current. It is activated directly by the negative pressure present in the blower chamber, which is slight when the filter is clean, but increases as the filter becomes dirty.

Two of the four holes drilled in the blower chamber wall are the orifices through which this negative pressure exerts its pull on a plastic indicating vane within the gage. Hinged at its back end, the vane can rotate from a horizontal position (indicating that filter is sufficiently clean), to a vertical position (indicating that the filter is dirty). The indicating vane is held in horizontal position by magnetic attraction plus the weight of an O-shaped vane which is hinged on a common axis with the indicating vane. Setting the gage to the requirements of different filters and installations is accomplished by a permanent magnet. This magnet, positioned directly under a metal disc in the center of the indicating vane, is mounted on the end of an adjusting screw.

It is made of plastic; has only two moving parts. Dimensions: 4 inches high by 2½ inches wide.

More information? Enter Item 37 on postcard, page 116

Pneumatic Instrument Filter

A compact air filter, designed to prevent dirt, oil, water and other foreign matter from entering pneumatic instruments, is announced by The Foxboro Co., Foxboro, Mass.

The filter consists of four major elements: a top cap with supply and outlet connections; a chamber with a drain cock at the bottom; a resin impregnated filtering sleeve; and a water baffle. The unit measures approximately 8½ by 4⅛ inches and can be mounted in a supported line or bolted to a wall or panel.

Supply air enters through the inlet port, strikes a baffle plate on the cap, enters the chamber, passes through the filter and leaves through the outlet port. Moisture drops to the bottom of the chamber and is easily drained off or blown out through the drain cock. The filter sleeve, of moisture-resistant cellulose, removes particles as small as 40 microns. It is inexpensive and can be easily cleaned or replaced.

Filter capacity is 4 cfm of air or natural gas. Catalog TI 29-A-92a is available.

More information? Enter Item 38 on postcard, page 116

Holds Styrofoam to Wet Surfaces

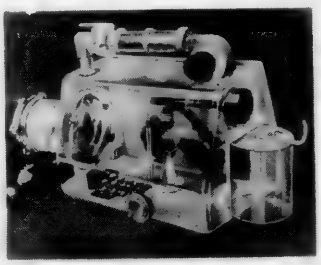
Field installation of Styrofoam insulation, product of The Dow Chemical Co., to wet tanks, pipes, ducts, and even under water to many surfaces, is claimed possible by Hayes Adhesives Co., Inc., St. Louis, Division Morningstar, Nicol, Inc. The company reports that its waterproof insulation cement No. 1484 can be applied by brush or spatula to sections of sheets or pipe covering and immediately bonded into place on a wide variety of wet and low temperature surfaces, such as are found in industrial piping and air conditioning projects.

The adhesive is tacky and gummy immediately after application and retains its clinging character indefinitely whether dried, exposed to dry, moist surfaces or even under complete immersion in water. Since the adhesive is unaffected by continual sweating of pipes and similar surfaces, no shut-down of equipment and lines is required for installation purposes. It is available in one and five gallon cans.

More information? Enter Item 39 on postcard, page 116

Control Hood for Labs

The Isolation and Atmosphere control hood for laboratories in industrial assembly use is being mass produced by P. M. Lennard Co., Inc., Brooklyn, N. Y. Made of plastic which is chemically inert, the device weighs 5% of that of a steel hood, one eighth that of a glass hood.



The hoods are designed to serve every purpose in the electronic-instrument, bearing and product assembly industries requiring controlled conditions during assembly or laboratory research. The integrated design of the units permits complete atmosphere controls such as rust control, relative humidity, temperature, maintaining inert gas or dust free atmosphere and permits a full isolated work area preventing damage by air-borne contaminants, and the basic design of the units allows for in-tandem assembly in industrial production lines.

The hoods offer complete protection from radio-active isotopes and dusts of Alpha and Beta energies and low energy Gamma rays. The extreme light weight of the unit, less than 20 pounds, permits change of location with greatest ease. All standard and optional equipment, such as air filtration, dehumidification, refrigeration, high temperature, airlock compartments, and glove port facilities have been tailor-made to the unit design.

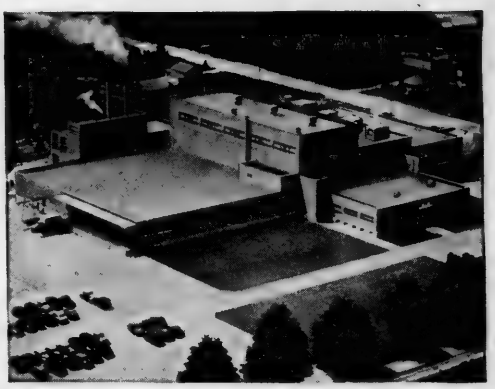
More information? Enter Item 40 on postcard, page 116

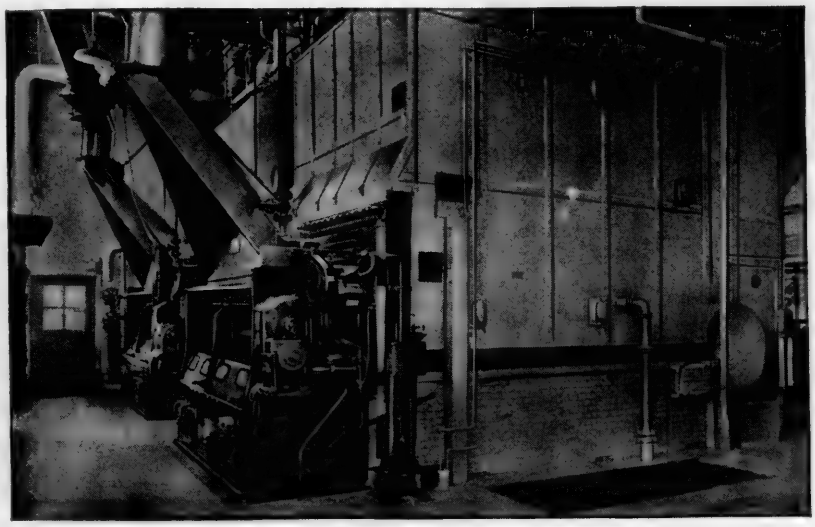
(*Continued on page* 112)

"COAL'S BEST FOR OUR MODERN PLANT!

It's low in cost . . . It's clean and convenient!"

says G. W. Peters, Engineering Manager
M&R DIETETIC LABORATORIES, INC.
makers of PREAM & SIMILAC





"We made a careful study of fuels and burning equipment before building our modern new plant in Sturgis, Michigan. This plant was designed to produce baby food. So the steam plant has to be clean and dust-free as well as economical to operate. Also, we wanted a fuel we could store safely and easily in order to insure ourselves against any shortages.

"We decided on bituminous coal—and the up-to-date installation shown here. It certainly fills the bill on every count. Our modern combustion equipment makes coal far more economical than any other fuel. Up-to-date coal and ash handling give us convenient operation completely free of dust nuisance."

Additional case histories, showing how other types of plants have saved money by burning coal the modern way, are available upon request.

Discover for yourself the great advantages of coal burned the modern way. Call in a consulting engineer. He'll show you how today's combustion equipment can give you 10% to 40% more power from a ton of bituminous coal than from equipment used only a few years ago. He'll show you how modern labor-saving coal and ash-handling equipment make a coal-fired installation clean, convenient, and dust-free.

If you plan to remodel or build a new plant, be sure to look into the low cost and convenience of bituminous coal. Consider coal's other advantages, too. It has reserves that are virtually inexhaustible. America's bituminous coal mining industry is the most efficient and productive in the world. With bituminous coal, you can be sure of plenty of fuel at relatively stable prices now and for years to come.

If you operate a steam plant, you can't afford to ignore these facts!

BITUMINOUS COAL in most places is today's lowest-cost fuel, and coal reserves in America are adequate for *hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Southern Building, Washington 5, D. C.

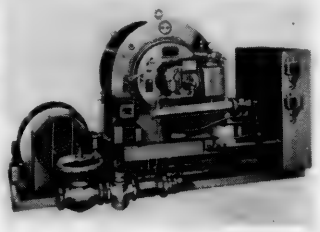
FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

(*Continued from page* 110)

Forced Draft Packaged Burner

A forced draft packaged burner, built to specifications for Scotch marine type boilers and other types of heat receivers designed for pressurized operation for industrial-commercial heating and power application, is being sold by Ray Oil Burner Co., San Francisco, Calif.



Burner specifications may be selected to burn any grade of fuel oil from the light No. 2 to the heavy No. 6 Bunker C and high or low pressure gas or a combination of both oil and gas.

The complete package includes a burner of any desired specification; forced draft fan; windbox with integral refractory; completely wired enclosed control panel; ignition and electronic safeguard systems, and constant velocity type air control assembly.

All components are completely wired, piped and mounted on a structural steel base ready to be installed on the boiler front. Only steam, water, electrical and fuel connections remain to be made and the burner is ready for operation.

More information? Enter Item 41 on postcard, page 116

Plastic Pipe Adapter

A metal adapter for plastic pipe which offers a flat clamping surface as well as four heavy serrations for maximum protection in connecting plastic pipe, is announced by The Capitol Manufacturing & Supply Co., Columbus, Ohio.

These fittings are available for either male or female pipe connections, and are supplied either galvanized steel or brass. There is also a long pattern 6, 8, 10 or 12-inch adapter for connecting plastic pipe directly to the jet assembly and protecting the venturi tube.

Sizes available are from ½ through 2 inches.

All fittings are conveniently cartoned and individually thread protected for ease of handling.

More information? Enter Item 42 on postcard, page 116

Solves Pilot Linting Problem

A solution to the problem of linted pilot burners and pilot generators in heating equipment has been placed in production by General Controls Co., Glendale, Calif.

These Snorkel pilot burners and pilot generators, particularly designed for above-the-floor heating installations which tend to collect dust and lint, operate on a principle of drawing primary air under the pilot flame before it is mixed with gas in a cool, sealed chamber. Bringing the air past the flame brings all dust and lint into contact with the flame, incinerating it and leaving the intake air completely clean and free of air-borne particles which tend to clog ordinary pilots.

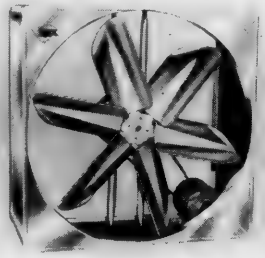
Additional prevention against plugging is provided by large-diameter pilot and thermopilot flame ports. Primary air is mixed with gas in the sealed, cool chamber to avoid cracking of the gas. The result is a crisp and steady blue pilot flame which is not subject to either clogged ports or an unsteady mixture of primary air and gas.

The PG-9 pilot generators, and 260S and 26S pilot burners are available for all the company's thermocouple-operated safety and self-powered control systems.

More information? Enter Item 43 on postcard, page 116

Ventilating Fan Line

Four variable-use ventilating fans are added to the line of Air Controls, Inc., Cleveland, Ohio. These models are readily adaptable for unlimited application in homes, apartments, stores, factories, and other locations requiring ventilation and air cooling.



They are housed in a heavy-gage steel cabinet. Six-bladed fan assemblies produce maximum air volume quietly and efficiently. Blade diameters from 24 to 38 inches produce from 3,850 to 10,000 cfm. Belt-driven for smooth and quiet performance, the fans can be supplied for either horizontal or vertical operation. Automatic wall or ceiling shutters, 2-speed motors, front and rear guards are available as optional accessories.

More information? Enter Item 44 on postcard, page 116

Measures Inaccessible Distances

A field range finder, for measuring distances from 8 to 100 feet without actually taping them or where distances are not able to be accurately measured, is a new product of Meyer-Opticraft, Inc. New York, N. Y. The over all accuracy is 2%.

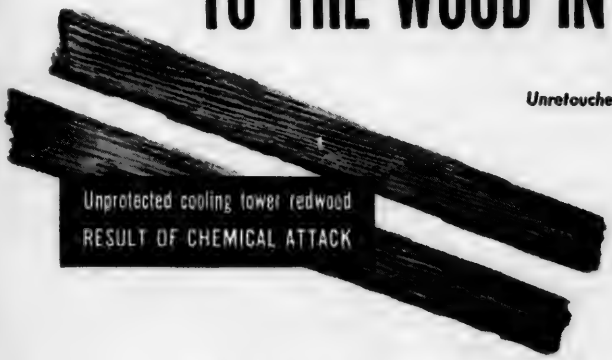
The field rangefinder is based on the triangulation principle employing two strongly contrasting images. On sighting through the eyepiece, two images of the object are visible—one white, one gold. Turning the knob in either direction causes the white image to move. When this image is clearly superimposed on the gold image, the rangefinder is in perfect alignment. Distance is then indicated on the dial.

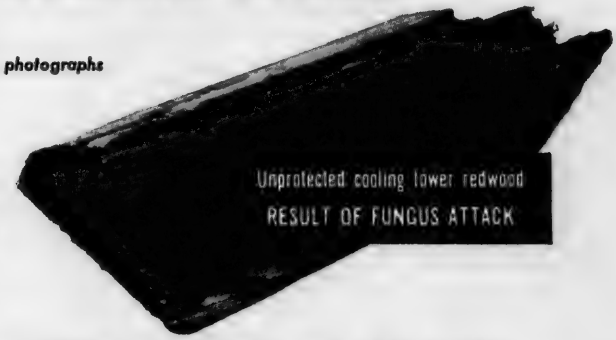
More information? Enter Item 45 on postcard, page 116

(*Concluded on page* 114)

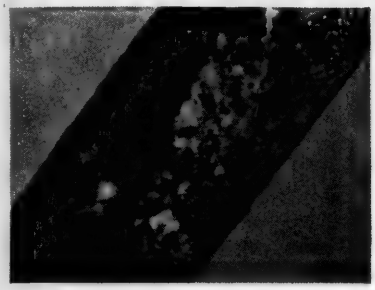
LOOK WHAT CAN HAPPEN TO THE WOOD IN COOLING TOWERS

Unretouched photographs





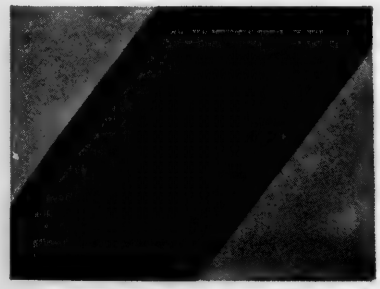
PRESSURE CREOSOTING ADDS YEARS OF LIFE TO HALSTEAD & MITCHELL COOLING TOWERS



FUNGUS ROTTED UNPROTECTED DECKING

Unretouched photographs

CLEAN PRESSURE-CREOSOTED DECKING



Examine these unretouched photographs carefully. Constantly wetted wood decking in a cooling tower is subject to immediate attack by fungus and marine parasites. It is also subject to chemical deterioration from acids in water. All wood used in Halstead & Mitchell Cooling Towers is protected against these twin enemies.

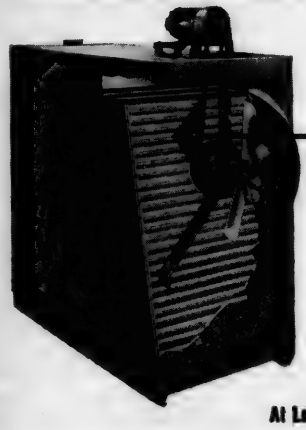
WHY PRESSURE CREOSOTING?

Creosote . . . *with 162 elements toxic to fungus growth and parasites* . . . also makes wood more resistant to chemical attack. Deep penetration of the wood by Koppers Pressure-Creosoting gives the longest possible wetted decking life. Therefore, all Halstead & Mitchell Cooling Tower decks are Pressure-Creosoted, and are guaranteed against rotting due to fungus growth . . . for 20 years!

ONLY HALSTEAD & MITCHELL OFFERS THE

20-Year Guarantee!

ON THE WETTED DECK SURFACE against rotting by fungus attack



2 thru 100 Tons

- Sheet-Steel Cabinets, 5-times protected
- Stainless Steel Fans and Shafts
- Weather Shielding
- Everdur Bolts for ease of disassembly at any time.

HM Halstead & Mitchell

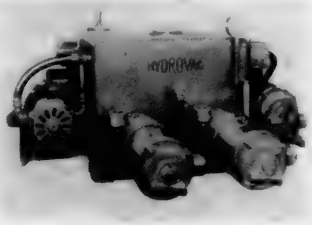
At Leading Refrigeration & Heating Wholesalers Everywhere

OFFICES: Bessemer Bldg., Pittsburgh 22, Pa.

(*Concluded from page* 112)

Vacuum Heating Pump Unit

A new 4-pump vacuum heating unit, Model VA, has been developed by American Hydrovac Div., Pitz Foundry, Inc., Brooklyn, N. Y., which incorporates several new features. The new unit consists of two separate motor-driven centrifugal pumps and two separate all bronze rotary vacuum pumps for air displacement.



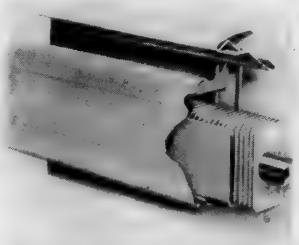
Principal features are a vacuum heating pump having considerable air handling capacity beyond the ratings as set forth by ASHVE for standard capacities normally specified for vacuum heating pump units, with an accompanying decrease in horsepower consumption. This model also permits full use of a true duplex unit, as both the condensate and the air pumps can be used for double capacity when required.

Other features of the new model are the elimination of many internal working parts which were customary with former designs, and a reduction in maintenance time.

More information? Enter Item 46 on postcard, page 116

New Line of Radiant Baseboards

A new addition to its regular line of radiant baseboards is announced by Kritzer Radiant Coils, Chicago, Ill. The addition is the K line, made specifically for residential and commercial heating.



A feature of the new baseboard is full length back and top of one piece. This imparts strength and rigidity so that it aligns the entire baseboard assembly and supports all elements. It acts as a barrier against heat loss into the walls as well as preventing dust streaks on wall surfaces. A support bracket snaps into both the back plate and the return edge of the top, establishing a foundation for carrying the coil and the snap-on front plate, as well as reinforcing the extended top.

A slide cradle fits snugly to the coil and prevents it from touching the front or back plate. The cradle moves with the coil during expansion and contraction, riding on the ribbed support bracket.

Accessories are available.

More information? Enter Item 47 on postcard, page 116

Water Defrost Package

Addition of a package accessory group for automatic control of Recold water defrost coils is announced by Refrigeration Engineering, Inc., Los Angeles, Calif. This is said to be the first time such a package control unit has been offered.

The package includes a timer, a solenoid valve and two safety devices, as well as complete accessories for controlling the frequency and timing of the defrosting cycle. The safety devices protect against the possibility of the drain pan overflowing from unusual obstructions due to foreign objects in the drain line or the sticking of the solenoid water supply valve.

A feature of the automatic water defrost control package is the simplicity of multiple unit installation. A number of water defrost coils can be defrosted from a single control unit. The unit can be used for fully automatic defrosting of all the company's ceiling blower coils with nominal capacities ranging from approximately ¼ to 3 tons and application temperatures from storage freezing down to extremely low blast freezing. The automatic control package may also be used on the company's floor type refrigeration units.

More information? Enter Item 48 on postcard, page 116

Insulating Tape for Cold Lines

Den-Ite insulation tape, developed as an insulating material for cold lines in air conditioning systems, commercial refrigerators, plumbing installations, and wherever the problem of condensation is encountered, is introduced by Dennis Chemical Co., St. Louis, Mo.

This No. 8525 cork insulation tape also provides an effective sound deadening barrier, and has been used successfully as a gasketing material. It has excellent adhesion to itself and all types of surfaces with no supplemental adhesives required.

More information? Enter Item 49 on postcard, page 116

Air Cooled Condensers

Completely automatic home cooling without the use of water has been introduced by General Electric Co., Bloomfield, N. J., as part of its 1954 line of air conditioners for the home. Waterless home cooling is made possible by a new air-cooled condenser developed by the company's Home Heating and Cooling Department.

The air-cooled condenser gives complete flexibility of installation because it can be located remote from the cooling unit in crawl space, attic, garage, or backyard. There will be an air-cooled counterpart for every water-cooled unit in the line, including upflow, downflow, and horizontal flow models.

The condenser package is only two feet high, three feet deep, and two or three feet wide, depending on capacity. At present, the company is marketing the new air-cooled unit in 2, 2½ and 3 ton sizes, with 1½ and 5 ton models to be available later this year. All its air-cooled equipment is rated by the company on the basis of cooling capacity rather than horsepower input because air-cooled units provide only about ¾ of a ton of cooling capacity per horsepower.

More information? Enter Item 50 on postcard, page 116

NOZZLES ARE THE HEART OF COOLING EFFICIENCY

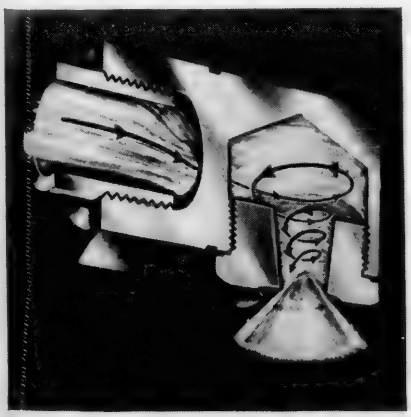
In early designs of large atmospheric cooling towers the water distributing system usually consisted of water box, flumes and distributing troughs. It was natural that engineers would look for a more efficient way to break up the water so that a greater area would be exposed to the cooling action of the air.

The first nozzles used for this purpose were crude, but a big step forward. After many refinements the Rotojet nozzle emerged as best suited for this work. It provided a hollow cone spray with remarkable fluid break-up.

For long life, low maintenance and high efficiency, cooling tower nozzles should be clog-proof and provide uniform spray patterns.

The Rotojets have no moving parts. They operate on the whirl chamber principle and are completely clog-proof under normal working conditions.

Engineers like the Rotojet for cooling tower installations because it is a precision-made nozzle. It is made in a wide range of sizes, permitting them to control the volume of water handled by a tower at a specified water pressure. This is important in the calculation of water to air ratios... the very heart of all cooling operations.



The whirl chamber principle of Rotojet nozzles gives maximum fluid break-up without the use of moving parts. This type of nozzle is clog-proof.

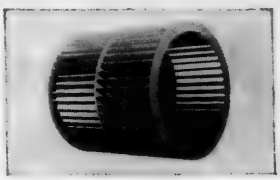
Full information on Rotojet nozzles and their many applications may be obtained by writing direct to the manufacturer, the Binks Manufacturing Company, 3120-38 Carroll Ave., Chicago 12, Ill. Adv.

Binks series 3-B cooling towers

So-o Quiet...

Hotel guests sleep undisturbed

Guest rooms are only a few feet from the Binks cooling tower installed in the light court of the Malburne Hotel, Durham, N. C. But no one has complained or lost a wink of sleep. Binks cooling towers of the Series 3-B type are exceptionally quiet and are ideal for use where any noise at all would be objectionable.



Here's one reason why these towers are so quiet

Binks squirrel-cage blowers provide ample air movement while running at quiet speeds... far slower than the noisy propeller fans used in conventional towers.

You pay no more for this *extra quiet operation* and you get all these additional advantages:

- Controlled air movement through the tower makes Binks Series 3-B units independent of natural breezes.
- Air current moves in opposite direction to downward water flow. This accelerates the cooling action.
- Only dry air passes through the air propulsion assembly. Corrosion and maintenance are thus reduced.
- Non-clogging ROTOJET nozzles produce fine fluid break-up for maximum cooling.

A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

REPRESENTATIVES IN ALL PRINCIPAL CITIES • SEE YOUR CLASSIFIED DIRECTORY

SEND TODAY for these bulletins:

No. 47-A—Type 2-B (3 to 30 tons)
No. 47-B—Type 3-B (1 to 108 tons)
No. 47-D—Type B-23-B (2 to 3 tons)

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EVERYTHING FOR WATER COOLING

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Gentlemen: Please rush FREE Cooling Tower Bulletins as checked:

☐ Bulletin 47-A ☐ Bulletin 47-B ☐ Bulletin 47-D

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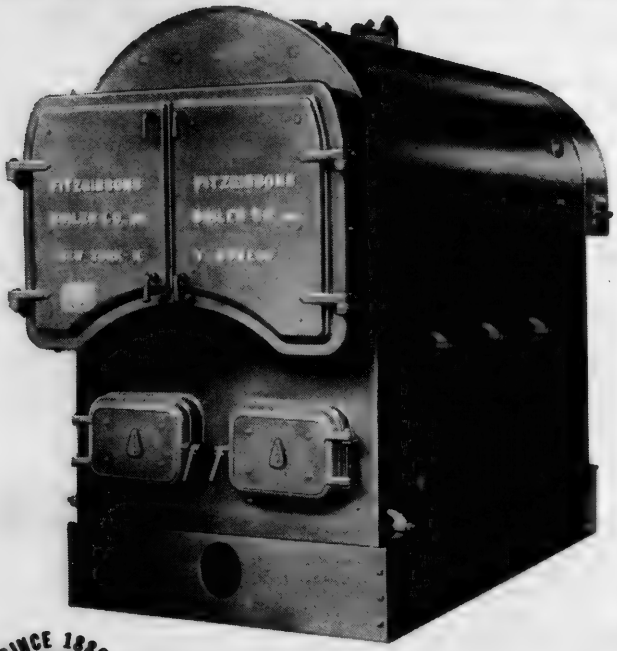
Company_____

Address_____

City_____ Zone____ State_____

THE NEW LORD & TAYLOR STORE IN WEST HARTFORD, CONN.
Architect: Irving W. Rutherford, Hartford, Conn.
Consulting Engineer: Harry H. Bond, New York, N. Y.
Heating Contractor: Eugene J. Brandt & Co., Inc., New York, N. Y.

As modern as the store it serves



THE FITZGIBBONS "D" TYPE STEEL BOILER is the choice for today's modern building because of its proven ability to provide up-to-date standards of comfort with lowest operating costs. Fitzgibbons design has no equal, and construction meets and frequently exceeds, ASME Code requirements. Its fine reputation among building owners, architects and engineers is further evidence of the kind of performance you can be sure of obtaining with a modern Fitzgibbons boiler installation. For complete details on the Fitzgibbons "D" Type boiler, write the Fitzgibbons Boiler Company, 101 Park Avenue, New York 17, N. Y. Ask for Catalog HV-8.

SINCE 1886 MOST ECONOMICAL IN FUEL 1886 THE FITZGIBBONS BOILER

The Fitzgibbons Boiler®

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· News of Equipment and Materials

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· New Catalogs

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NEW CATALOGS

ELECTRIC REFRIGERATION UNITS — A new 8-page catalog B-54, on its belt-driven condensing units and compressors is published by Copeland Refrigeration Corp., Sidney, Ohio. This catalog contains illustration and specifications on standard air- and water-cooled models of the company's electric refrigeration units. It also includes pertinent data on other models, such as combination air- and water-cooled units, gasoline engine-driven models and truck-type models. One complete page is devoted to a chart showing capacity data on various models of belt-driven condensing units and compressors. .....Item 181

SNOW MELTING SYSTEMS—How Snow Melting Combats Winter Traffic Problems, is the title of a special, 30-page report recently prepared by the Engineering Service Dept., A. M. Byers Co., Pittsburgh, Pa. The illustrated report is based on an analysis of snow melting systems in which heated water mixed with anti-freeze is circulated through wrought iron pipe coils or grids embedded in paved roadways. Included in the preface to the presentation of specific installations are a list of the advantages of snow melting and a discussion of construction and operational costs. Much of the report is devoted exclusively to snow melting systems serving roads and highways. The last half of the report deals with off-the-street snow melting facilities installed in driveways and parking areas of banks, garages, service stations, warehouses and similar business establishments. .....Item 182

CENTRAL AIR CONDITIONING UNITS—Ceiling-mounted and floor-mounted central station air conditioner units for commercial and industrial applications are the subject of a new bulletin now being offered by Worthington Corp., Harrison, N. J. The bulletin is illustrated and gives specifications, dimensions, accessories, physical data and features of the AHY ceiling-mounted and AVY floor-mounted units. .....Item 183

PACKAGED BOILERS FOR HOSPITALS —A new four-page folder, Bulletin 1223, just completed by Orr & Sembower, Inc., Reading, Pa., describes two types of Powermaster packaged automatic boilers in seventeen sizes from 5 through 500 hp for steam processing as well as steam and hot water heating service as applied to hospitals. This includes replacement as well as new construction. The front cover of the bulletin describes the advantages of packaged automatic boilers contrasted with equipment of conventional design. A triple installation of gas- or oil-fired 300 hp boilers is illustrated on the front cover and two 60 hp heavy-oil units together with two 250 hp dual fuel Powermasters are shown on the back cover. Constructional and operational characteristics of the boilers are described and pictured. The firing equipment for two available lines covering light and heavy oils as well as gas is described. A partial list of typical installations in hospitals appears on the back cover. .....Item 184

STEAM HEATING SYSTEMS AND CONTROLS—Bulletin 110 has been issued by Illinois Engineering Company, Division of American Air Filter Co., Chicago, Ill., covering its heating systems and controls. The bulletin is a condensed catalog, 20 pages, and includes sections on the company's Selectotherm, continuous flow control systems, vacuum systems, cycling flow control systems, vapor systems and a section on steam power. .....Item 185

CLAY PRODUCTS — PIPE, FITTINGS, FLUE LINING—A comprehensive, 62-page catalog covering its complete line of vitrified clay pipe, fittings, flue lining, wall coping, septic tanks, liner plates, chimney tops and other clay products, is issued by Superior Clay Corp., Uhrichsville, Ohio. Completely illustrated, this attractive pocket-size, spiral-bound catalog is indexed for easy reference. .....Item 186

TUBING AND LINE PIPE—The Fibercast tubing and line pipe of The Fibercast Corp., Sand Springs, Okla. is described in a profusely illustrated bulletin. Fibercast is said to be a product of thermosetting resins reinforced with glass fibers and cured by heat. The pipe is non-corrosive and is made in 20-ft. joints, using a centrifugal casting method. .....Item 187

INDUSTRIAL CLIMATE CONTROL. — The Niagara Type A model industrial air conditioning unit is described in a colorful 8-page bulletin No. 122, completed recently by the Niagara Blower Co., New York, N. Y. The bulletin deals primarily with the varied uses and applications of the air conditioner. Typical industrial installations in textile mills and testing laboratories where precise control is important are illustrated. A combination schematic—cutaway drawing points up the components of the unit and its cycle of operation. A description of the company's system of automatic control by use of thermostats is briefly but clearly discussed. .....Item 188

RADIANT CEILING BULLETIN—Bulletin No. A-123-1, supplementing a previous bulletin on its 3-way functional ceiling, is issued by Architectural Products Div., Burgess-Manning Co., Chicago, Ill. Principal change in the supplemental bulletin is a simplified method for evaluating the costs of this new ceiling which heats or cools radiantally and provides acoustical control. .....Item 189

ADDITIONS TO BOILER LINE — A new master catalog for its R-Z-U Junior steam boilers that includes fuel data on four new sizes in the line has been released by Fitzgibbons Boiler Co., Inc., New York, N. Y. Previously available in sizes from 1100 to 3000 net sq ft steam, this boiler for schools and all small buildings now comes in sizes up to 5000 net sq ft steam and 5000 net sq ft water. The new catalog also points out that ratings of all R-Z-U Junior boilers should be increased by 12½ percent where forced hot water circulation is used, in accordance with the recent revisions in the ASA Code. .....Item 190

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HEATING AND VENTILATING
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NEW YORK 13, N. Y.

READERS' SERVICE DEPT.

HEAT PUMPS — The functions of heating in winter, cooling in summer as performed by the company's Flow-Temp heat pumps are fully described in a new catalog published by Acme Industries, Inc., Jackson, Mich. The use of water from well, river, lake or stream as a source of clean, flameless heat is explained, as well as the removal of heat from the interior of a building in warm weather. Change-over from heating to cooling is described. Typical installations of the heat pump are graphically portrayed, both with remote room conditioners and with radiant piping, and examples of their operation in various climate zones throughout the country are cited. Office buildings, schools, banks and motels, as well as homes, are included in the installations listed. Six different models are listed for both heating and cooling and an additional six models for heating alone. A table also shows the heat output obtained under other common operating conditions and gives the cooling capacities of all 12 models for summer air conditioning. .....Item 111

INSTANT WATER COOLING — In a new bulletin, No. 153-I, released by Frick Co., Waynesboro, Pa., the principles and applications of instant water cooling and the characteristics of the company's instant water coolers are discussed. Installations for dairies, air conditioning, carbonated beverage plants, drinking water systems, ice plants, breweries, process work, frozen confections, and for brine and other liquids are described and illustrated. Details of construction are discussed and illustrated in text, photographs and drawings. .....Item 112

NEEDLE THROTTLING VALVES — A description of its line of needle throttling valves is presented in a new catalog, NV-1, published by Marsh Instrument Co., Skokie, Ill. Descriptions and photographs of each of the models is included, as well as a cut-away view pointing out the features of this valve. In addition, there are drawings of each type with tables of specifications. A chart of flow characteristics is also included. .....Item 113

CENTRIFUGAL PUMP FUNDAMENTALS —Centrifugal Pump Fundamentals, is the title of a most interesting 12 page booklet (Form 7267) issued by Ingersoll-Rand Co., New York, N. Y. Written in simple language and illustrated with easily understood diagrams, it should be useful to all pump operators and installation and maintenance men as it explains the principles of operation, defines the various terms used in pump calculations and works out typical pump problems. Included are chapters on centrifugal pump analogies, how to calculate, total head or pressure, capacity or quantity delivered, specific gravity or weight of liquid, hydraulic and brake horse power, and pump pressure. .....Item 114

FLOW CONTROL VALVES—An information folder about its flow control valves is issued by The Dole Valve Co., Chicago, Ill. Applications to tankless water heaters, drinking fountains, soda fountains, water softeners, lavatories, showers, water tanks, flush tanks, water pumps, and irrigation sprinkler heads are described and illustrated. Tables of stock sizes are given as well. .....Item 115

INSULATED ROOF DECKS—Fireproof, insulated, roof decks are covered in three new technical folders issued by Vermiculite Institute, Chicago, Ill. Poured-In-Place Vermiculite Concrete Over Vented Steel Roof Decks describes a recent development that permits considerable flexibility in joist spacing and slab thickness, while Vermiculite Concrete Roof Decks Over Paper-Backed Wire Lath is the title of two folders covering steel or concrete joist construction where the joist spacing does not exceed 32 inches on centers. One folder is an alternate designed for regions where temperatures are 50 deg or above during the pouring and curing period. ...Item 116

AUTOMATIC VACUUM HEATING SYSTEM—A 16-page bulletin No. 540 has been issued by Illinois Engineering Co., Division of American Air Filter Co., Chicago, Ill., entitled, Tune in With the Weather—Illinois Selectotherm, and devoted to the company's automatically controlled high vacuum steam heating system. How this system operates, engineering details, components, performance data and installations are included. .....Item 117

HEAT TRANSFER EQUIPMENT—In four new bulletins, DS-352, DS-361, D3-362, and DS-327A, are described three product lines of the Trane Co., La Crosse, Wis., its improved, self-contained air conditioning units, the cold generator line with capacities extended to 100 tons, and improved Torriders with Delta-Flo fin coils. Complete information, including capacity tables and roughing-in dimensions on cold generators and the company's line of packaged water chillers, is available in bulletin DS-352. In addition to information on new Freon 22 units and duplex models, bulletin DS-361 has capacity tables, specifications and information on operating features of the company's compressors and condensing units. Bulletin DS-362 presents complete information on improved, self-contained air conditioning units, including line diagrams, wiring diagrams, capacity tables and helpful examples of unit selection. The Torridor, a high capacity blower type unit heater is described in Bulletin DS-327A, including roughing-in dimensions, and capacity tables. .....Item 118

COOLING TOWERS — A completely new residential cooling tower catalog, No. RE-1, offered by Halstead & Mitchell, Pittsburgh, Pa., describes in detail the mechanical physical and operating characteristics of the company's latest line of residential cooling towers for air conditioning. The 8-page catalog describes these towers, presenting graphically, tower capacities for various wet bulb temperatures. Indoor and outdoor tower installations are both shown in full-page line diagrams. .....Item 119

MAGNETICALLY DRIVEN CENTRIFUGAL PUMP—A new magnetically driven centrifugal pump, called the Dynapump, is described in a four-page bulletin offered by The Fostoria Pressed Steel Corp., Fostoria, Ohio. This fractional horsepower pump is described as being driven by a rotating magnetic field instead of the usual drive shaft. The motor and pump are in one sealed unit, and there is no need for a shaft seal or stuffing box, the bulletin states. .....Item 120

SPACE HEATERS — A brochure of engineering case studies, recently released by Dravo Corp., Pittsburgh, Pa., describes nine ways in which warm air space heaters were used to heat a variety of diversified manufacturing plants. Each bulletin in the brochure describes an individual plant's requirements and lists the benefits derived by installing oil- or gas-fired warm air space heaters. Industries featured are: Paint and glass work, clothing, wiping cloth processing, radio assembly, starch laboratory, plywood manufacturing, granite polishing and inscribing, mining tool construction and pulp wood log debarking. .....Item 121

FREON CONDENSER — A new bulletin, published by Doyle & Roth Mfg. Co., Inc., Brooklyn, N. Y., describes that company's Freon condenser. The bulletin gives specifications, line drawings, and roughing-in dimensions. On the back page are listed other types of equipment offered by the company, including several types of coolers. .....Item 122

ELECTRONIC MOTOR REGULATOR — A two-page bulletin K-2676, describing and illustrating the VER, electronic regulator for speed, voltage, and current (tension) regulation for industrial electric motor drives has just been issued by the Reliance Electric and Engrg. Co., Cleveland, Ohio. With illustrations and a diagram, the bulletin explains the function of the regulator in controlling motor or generator field excitation in response to the input signal from regulated quantity. .....Item 123

GAS-FIRED UNIT HEATERS—How, why and when to use gas-fired unit heaters is outlined in a Bulletin SA-541-A prepared by the Reznor Mfg. Co., Mercer, Pa., for distribution to architects, builders and heating engineers. Included in the pocket-size, 20-page booklet are hints on heater selection and installation, a schematic diagram explaining how a gas unit heater works, a heating survey outline, instructions for estimating heat loss and computing gas line requirements and a summary of gas unit heating. .....Item 124

PLEASE SEND US MORE INFORMATION

WRITE IN, below, the Item numbers on which you wish further information —

Item No.	Item No.	Item No. .....
Item No.	Item No.	Item No. .....
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Aug. H-54

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p-k Freon Coolers

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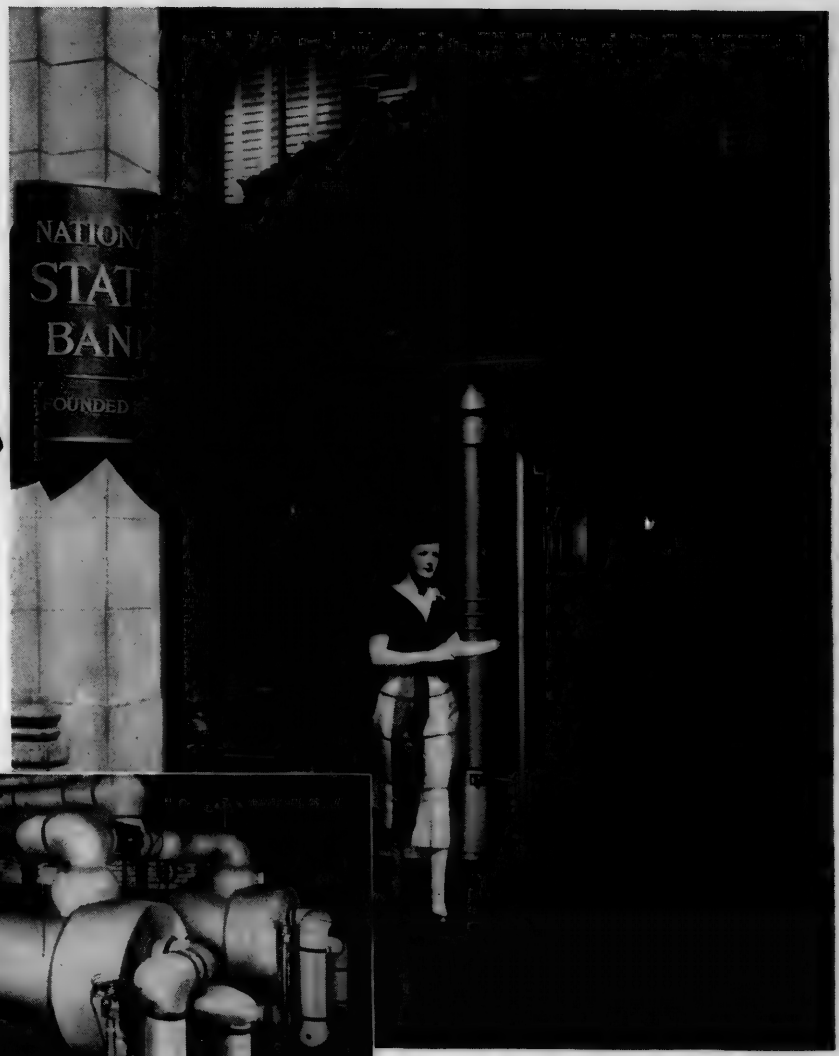

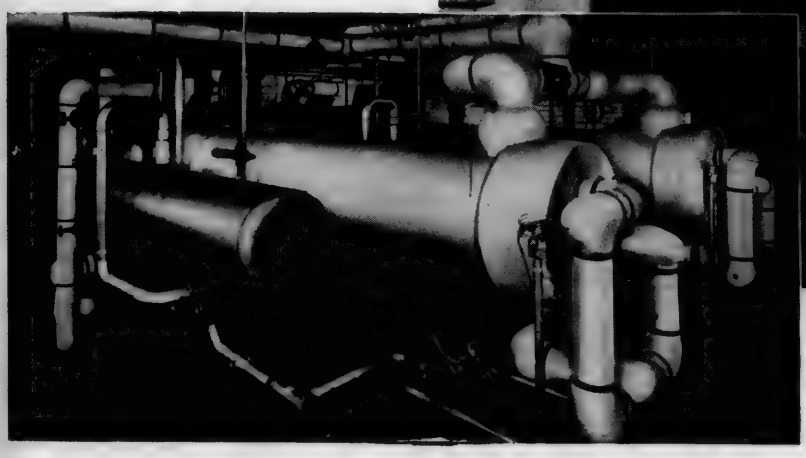

National State Bank Building in Newark, New Jersey. p-k Freon 22 Coolers were specified by Delta Engineering and Conditioning Co., Inc., East Orange, New Jersey. "We specify them because they are the best" says William Adelman of Delta.

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What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

WHILE a plant engineer may be interested in the installation and operation of an industrial exhaust system, those concerned with plant costs would like to know what it costs to own and operate such an exhaust system.

Such a figure takes into account a number of factors such as duct size, cost of erection, weight of sheet metal used in ducts, space occupied by the ducts, power cost, efficiency of blower and motor, air pressure and friction loss.

Information on this duct charge is based on a question that was submitted. Should you have a problem that you would like to see discussed in this department, or if you have some comments that you would like to add to the discussion scheduled for the next issue, you are invited to write to the Editor.

This Month's Problem

The cost accountant at our plant is interested in obtaining the annual cost to own and operate the industrial duct system in our plant. If there is a simple way to arrive at this figure, it would be helpful to learn how this is done.

This Month's Problem

In arriving at the information you require, it is necessary to find three separate factors such as (1) annual capital charge, (2) space rental charge, and (3) annual power cost.

The annual capital charge on the cost of the investment in ductwork in dollars per year may be expressed as:

$$\text{Annual capital charge} = \frac{IZWL}{100} \pi \frac{d}{12} \qquad (1)$$

where L is the length of duct in feet; d is duct diameter in inches; Z is the cost of erected ductwork in dollars per pound; W is the weight of sheet metal in pounds and I is the annual fixed charge in per cent. The value of Z varies with the geographic location and economic conditions. Based on 1951 costs in New York City, as reported by local sheet metal contractors, it is $.50 per pound.

The need for a space rental charge for ductwork arises

(*Concluded on page* 120)

TABLE 1—GAGE AND WEIGHT OF GALVANIZED SHEET STEEL DUCT

Duct Diameter, Inches	Gage	Weight of Steel, Lb per Sq Ft
Up to 8	24	1.2
8 to 18	22	1.4
18 to 29	20	1.7
30 and over	18	2.2

TABLE 2—COST TO OWN DUCTWORK

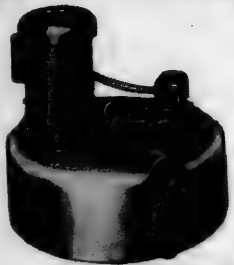
Annual fixed charge at 10%; cost of duct at 50¢ per pound; space rental at 15¢ per cu ft per year; duct gages as per Table 1.

Diameter of Duct, Inches	Annual Capital Charge, Dollars per Yr per Ft of Length, Equation (1)	Space Rental Charge, Dollars per Yr per Ft of Length, Equation (2)	Cost to Own Dollars per Yr per Ft of Length
3	.047	.000	.047
4	.063	.001	.064
5	.079	.001	.080
6	.094	.002	.096
7	.110	.003	.113
8	.147	.004	.151
9	.165	.006	.171
10	.183	.008	.191
11	.202	.011	.213
12	.220	.014	.234
13	.238	.018	.256
14	.257	.023	.280
15	.275	.028	.303
16	.293	.034	.327
17	.312	.040	.352
18	.402	.048	.450
19	.423	.056	.479
20	.445	.066	.511
21	.467	.076	.543
22	.490	.087	.577
23	.512	.100	.612
24	.534	.113	.647
25	.556	.128	.684
26	.579	.144	.723
27	.601	.161	.762
28	.623	.180	.803
29	.645	.200	.845
30	.864	.220	1.084
31	.893	.244	1.137
32	.922	.268	1.190
33	.950	.294	1.244
34	.979	.322	1.301
35	1.01	.352	1.362
36	1.04	.382	1.422

Problem for the Next Issue

I would appreciate whatever information you may have regarding accepted methods for hanging ducts. Are there any regulations regarding the design of access doors for use with ducts?

LOW PRESSURE SYSTEM *Condensate Pumps*



SINGLE UNIT—Fig. 302A
10 Gal. Receiver for Single Units
Diameter 21"
Hgt. of Return above floor 6⅞"

Capacities 500 to 10,000 sq. ft. E.D.R.

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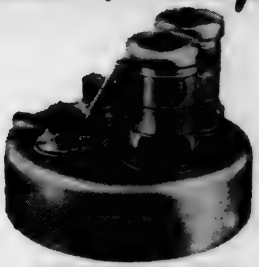

DUPLEX UNIT—Fig. 303B
15 Gal. Receiver for Single or Duplex Units
Diameter 25½"
Hgt. of Return above floor 7³⁄₁₆"

TVC SELECTION TABLE

Unit Number	Max. Sq. Ft. E.D.R.	Discharge Pressure At Pump	G.P.M. From Radiation	Cap. of Pump	H.P. of Motor	Return Inlet	Pump Discharge	Dia. of Receiver	Height of Unit
TVC 13	500	20 lbs.	.25	1.0 GPM	1/4	2"	1"	21"	21"
TVC 19	750	20 lbs.	.38	1.5 GPM	1/4	2"	1"	21"	21"
TVC 23	1000	20 lbs.	.5	1.5 GPM	1/4	2"	1"	21"	21"
TVC 29	2000	20 lbs.	1.0	3.0 GPM	1/4	2"	1"	21"	21"
TVC 35	4000	20 lbs.	2.0	6.0 GPM	1/4	2"	1"	21"	21"
TVC 41	6000	20 lbs.	3.0	9.0 GPM	1/2	2"	1"	21"	23½"
TVC 47	8000	20 lbs.	4.0	12.0 GPM	1/2	2"	1"	25½"	23½"
TVC 52	10000	20 lbs.	5.0	15.0 GPM	3/4	2"	1"	25½"	27½"

See Bulletin TVC-300-C for Full Specifications

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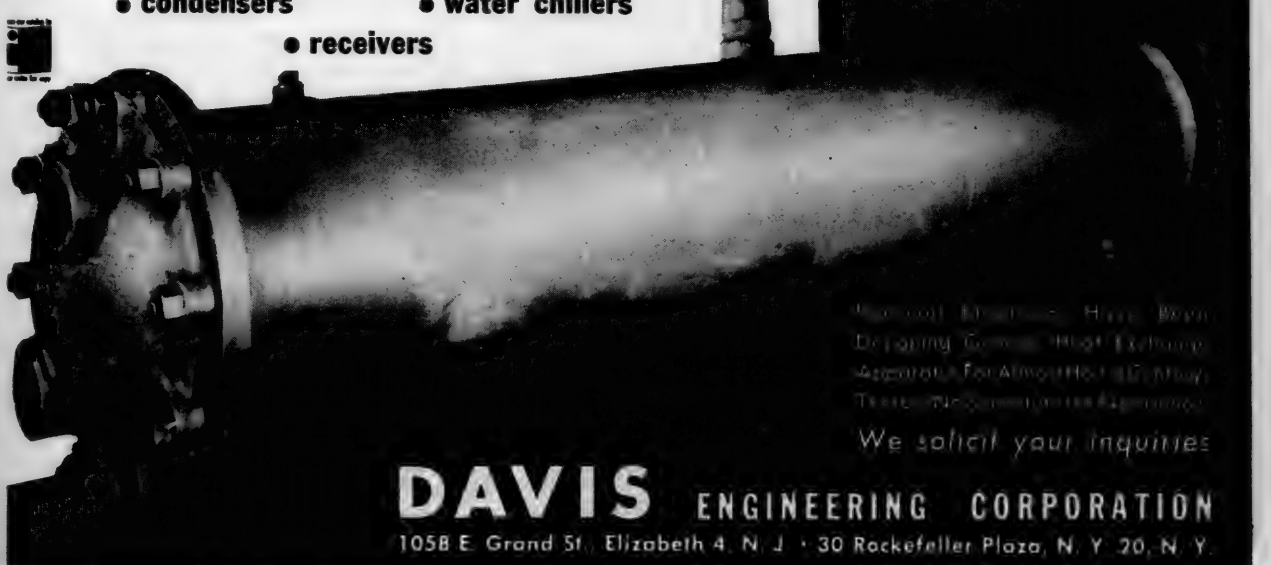

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What Would You Do?

(*Concluded from page* 118)

from the fact that when large quantities of air are moved at low velocities, the cubage occupied by the duct becomes significant and may reduce otherwise usable workroom space.

$$\text{Space rental} = \frac{d}{100} RL\pi \left(\frac{d}{2 \times 12}\right)^2 \qquad (2)$$

where R is space rental per cubic foot in dollars per cubic foot per year and the other factors (L and d) are as defined for equation (1).

It will be noted in equations (1) and (2) that once values are assigned to L, Z, W and R, the cost to own ductwork can be expressed in dollars per foot of length per year for each nominal diameter d. Table 2 is a tabulation of these values with the assumptions noted, and Table 1 gives the weight of galvanized sheet steel duct for various duct diameters.

The cost to move air through the ductwork is primarily the annual cost of electric power. A secondary factor is the increased cost of motor and fan as design velocity increases. This latter fact is, within limits, somewhat offset by a decreased fan cost due to decreased fan size, and the fact that fan size is more of a factor of quantity than design velocity. Because of this, the factor of fan and motor cost was not included in these computations. Therefore, annual power cost is expressed as given in equation (3).

$$\text{Annual power cost} = \frac{0.746\, hQYP}{6356e} \qquad (3)$$

where Y is hours per year exhaust system is operating; P is cost of electricity in dollars per kilowatt hour; h is the head which must be applied by the duct fan to produce the movement of air through the duct in inches of water; Q is air quantity in cubic feet per minute; e is the efficiency of fan and motor as a decimal.

Instead of h in equation (3), we can substitute another term as:

$$h = \left(\frac{12\, fL}{d} + k\right) h_v$$

where f is the friction factor, h_v is the velocity head in inches of water, $\left(\frac{V}{4005}\right)^2$

L and d are as previously defined; and V is duct velocity in feet per minute.

The annual cost to own and operate exhaust ducts is the sum of equations (1), (2) and (3), as follows:

$$\text{Annual cost} = \left(\frac{\pi IZWdL}{1200}\right) + \frac{\pi Rd^3L}{57{,}600} + \frac{0.746\, QYPh_v}{6356e}\left(\frac{12\, fL}{d} + k\right)$$

In the commonest type of duct system, with the entrance and exit velocity substantially the same, k will vary from 1.04 to 1.93 or higher for poorly designed system. In general, one will find that k will be somewhere between 1 and 2.

Arthur C. Stern
Chief, Engineering Unit,
Division of Industrial Hygiene and Safety Standards
Department of Labor
New York, N. Y.

Properties of Plastic Film

Investigations of the physical and permanence properties of plastic film are being conducted by M. C. Slone and F. W. Reinhart of the National Bureau of Standards. At present, measurements have been completed on tensile properties, water absorption, water vapor permeability, folding endurance, tear strength, low temperature impact strength, specific gravity and flammability. Burst strength and accelerated weathering are being studied.

The studies are based on 168 samples of plastic film which were received from 27 manufacturers. These samples represent the following 13 types of films: Cellophane, cellulose acetate, cellulose acetate butyrate, cellulose triacetate, ethyl cellulose, polyethylene, polystyrene, polyester, saran, polyvinyl, polyvinyl chloride-saran laminate, and polymethyl methacrylate. Test specimens were prepared from samples that were free of creases, wrinkles, foreign matter or other flaws. Before testing, they were conditioned for at least 48 hours at 23 deg C and 50% relative humidity.

Results of several of the tests, such as water vapor permeability, change in linear dimensions, and flammability, indicate the wide range of characteristics often available in one type of film. For example, some vinyl films are non-inflammable while others burn at a rate of 1.5 inches per second. The water vapor permeability rate of one cellophane may be 100 times that of another.

Table 1 gives the water permeability of plastic film and the number of samples tested. Three specimens were selected for each of the samples tested to get more accurate findings for the samples.

TABLE 1. WATER VAPOR PERMEABILITY OF PLASTIC FILMS.

Material	Number of samples[b]	Permeability constant[a]	
		Average	Range[c]
Cellophane:			
Non-moistureproof	2	2.04	1.42 to 2.65
Intermediate-moistureproof	1	1.23	.....
Moistureproof	6	.18	.01 to .73
Cellulose acetate	11	6.18	1.44 to 8.78
Cellulose acetate butyrate	2	5.51	4.53 to 6.48
Celluluose triacetate	4	5.61	4.77 to 6.01
Ethyl cellulose	2	13.35	12.54 to 14.15
Polyethylene	10	.06	.04 to .08
Polystyrene	3	.62	.50 to .70
Polyester	2	.10	.08 to .11
Saran	3	.02	.01 to .03
Polyvinyl alcohol	1	.10	.....
Polyvinyl chloride	11	.92	.35 to 2.01
Vinyl chloride-saran laminate	1	.04[d]	.....
Polymethyl methacrylate	1	.53	.....

[a]Expressed as grams transmitted in 24 hours by an area of 1 m² through a film 1-mm thick and with a pressure differential of 1 cm of mercury.
[b]Three specimens were tested for each sample.
[c]Individual values are results for a sample and not individual specimens.
[d]Calculated using over-all sample thickness. The value is 0.01 based on the thickness of the saran film alone.

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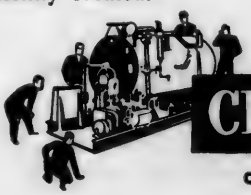

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PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

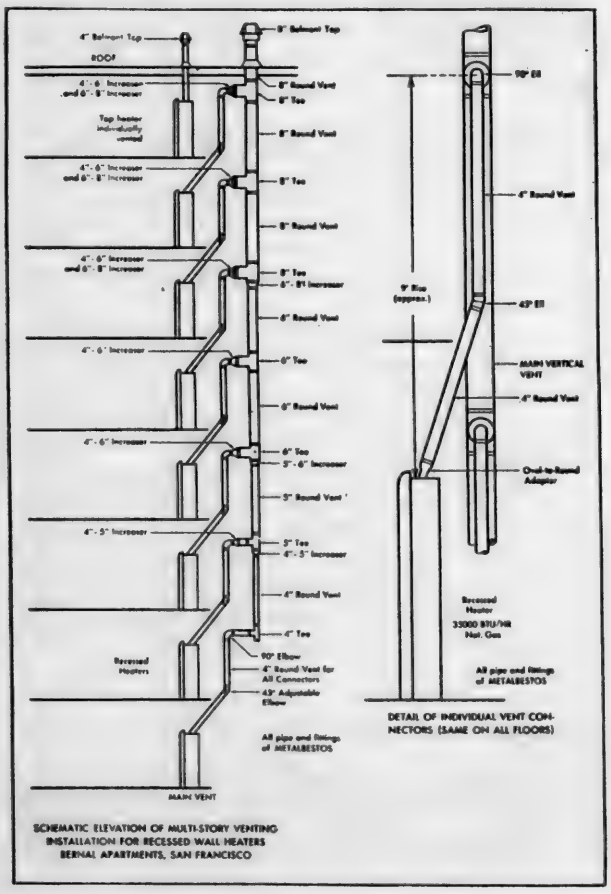
Multi-Story Vents Aid Apartment Heating

PROBLEM: Resettlement of families living in sub-standard housing involves construction of large multi-story apartment buildings at the lowest possible first cost. One item that offers opportunity for substantial savings is a heating arrangement making use of natural gas in individual apartment heating devices instead of the usual large central heating plant. However, this approach presents the problem of multi-story venting for which there seemed to be no ready solution at the time of a U. S. Housing and Home Finance Agency survey in 1951. The problem was studied by a coordinating committee set up by the Gas Appliance Manufacturers Association.

SOLUTION: One company agreed to design, build and guarantee vents which were installed in the 8-story apartment unit of the Bernal Buildings Project in San Francisco, Calif. It is pointed out by E. D. Adams, chairman of the coordinating committee, that effectiveness of a multi-story vent arrangement is dependent primarily upon the amount of heat in the vent gases and the degree of conservation of that necessary heat by means of well insulated flue passage ways. The weight of the flue gases resulting from combustion of 1,000 cubic feet of natural gas in heating service is approximately 2,400 pounds. Heat energy in the flue gases is the source of power needed to move such substantial weights. Since the flue gas temperatures of various types of equipment differ considerably, multi-story vent design must take into account the characteristic of the equipment to be vented. For example, it is well established that the flue gas temperatures of water heaters are considerably lower than the flue gas temperatures of vented recess wall heaters, such as those used in the Bernal apartments.

Another element in the design was the avoidance of the possibility of flue gases from one apartment backflowing into another apartment. In the Bernal apartment design there is sufficient rise in the individual vents to assure satisfactory discharge to the main stack without aid from the venting power in the main stack.

RESULTS: This design provides proper venting of each unit without dependence on the operation of any other unit. It practically precludes the possibility of reverse flow from the common stack. While the Bernal apartments are 8-stories, calculations governing flue operation indicate that a similarly designed flue system with the same flue gas temperatures could handle a 10-story building without difficulty. Results of the field tests showed that multi-story vents of individual apartment heating devices are practical if properly designed. It may be concluded that the vents in the Bernal apartments are properly designed and function efficiently.



SCHEMATIC ELEVATION OF MULTI-STORY VENTING INSTALLATION FOR RECESSED WALL HEATERS BERNAL APARTMENTS, SAN FRANCISCO

Conductive Rubber Panels Warm Motel

PROBLEM: The new Belvedere Motel in San Antonio, Texas, needed a heating system which would eliminate soot which made redecorating necessary every month.

SOLUTION: Uskon, which are thin panels of electrically conductive rubber, manufactured by U. S. Rubber Co., were glued to the ceilings of the 42-unit motel. Special adhesive was used to glue the panels which operate off a standard 230-volt system.

RESULTS: The panels give soot-free heat that eliminates the need for redecorating every month. They also allow all floor space to be utilized, making rooms seem bigger. The panels add a safety factor in that they are out of the reach of children. The panels are controlled by thermostats in each room. When in use, their entire surface heats up uniformly, providing adequate radiant heat in 20 minutes. They are expected to last the life of the building.

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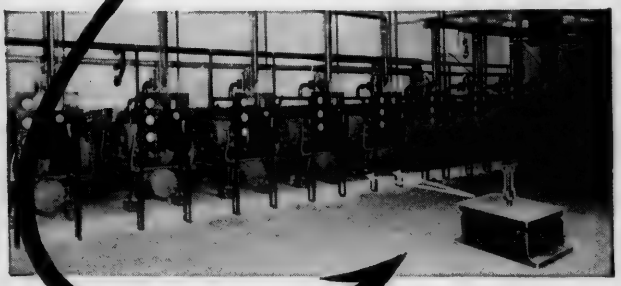

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- Permit higher operating speeds
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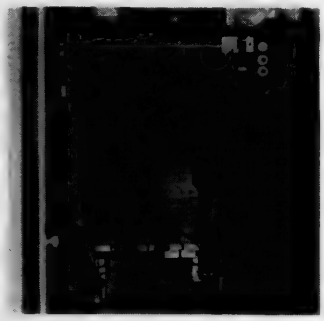
Shopping Center Installs Heat Pumps

PROBLEM: In construction of the Levittown Shopping Center in Levittown, Pa., early recognition of a requirement for both heating and air conditioning prompted the decision to build cooling equipment into the original structures. Since some store spaces in the shopping center measure 80 feet in depth and are joined back to back, a central heating plant in the middle to service any two stores would make it necessary to pipe oil over 80 feet.

SOLUTION: Heat pumps have been installed in many of the stores. Already nearly 250 tons of air conditioning are supplied by heat pumps in the shopping center and approximately 30 tons will be added in the near future. The largest single heat pump in the area is in the administration building where there are 100 tons of heat pump capacity. One of the commercial buildings carries a total of 115 tons comprising a 90-ton Carrier central plant and the balance in Typhoon packaged heat pump units distributed in various stores. The systems are installed by the Tullytown Supply Corporation and leased with the building space to the tenants.



RESULTS: Charles Barrows, chief engineer of Tullytown Supply Corporation, who handles all planning, design and installation of the heat pump machinery himself, maintains that heat pumps offer some important advantages in addition to their overall cost saving features. One important advantage is that, since the heat pump operates entirely on electricity, there is no smoke problem as with other types of fuel. Heat pumps also provide immediate switch-over, an important asset in commercial installations where a change-over is frequently required several times a day. The fact that an independent water supply with suitable characteristics is available in the area makes heat pump installation advantageous, with a practical limit of about 1,000 tons total installation set by the fact that there are only 2,000 gallons of water per minute available for the purpose. Heat pump operation in this area requires 2 gallons per minute per ton at full load. While Mr. Barrows does not favor residential use of heat pumps in the Levittown locale, he points out that cost is an important factor in favor of the heat pump for commercial purposes. For units as large as the one in the administration building, it is less expensive to install change-over equipment for heat pump operation than to put in a separate heating system. But even for single packaged heat pump units, the initial cost is roughly the same as for combined heating and cooling units, and installation costs are the same as for air conditioning alone. The electric rate for operating a small heat pump in winter in the Levittown commercial area compares favorably with the cost of burning No. 2 fuel oil at about 12½ cents per gallon. With larger heat pump installations and the lower electric rate, the cost of operation decreases substantially.

Pipe Line Company Prevents Vibration

PROBLEM: The Pacific Gas & Electric Co., in planning construction of the new 34 inch diameter natural gas pipe line known as Super-Inch, sought to provide for elimination of expected vibration, which they knew would result from pulsating gas under pressure.

SOLUTION: Burgess-Manning engineers studied the company's specifications for damping pulsation in the several stations along the proposed line. Suction and discharge snubbers of suitable size and construction were specified. After the line was completed, Burgess-Manning field engineers conducted pulsation surveys of the stations to check on performance of the snubbers. The surveys were conducted with electronic equipment including pressure pick up transducers, amplifiers and oscilloscopes.

RESULTS: It was found that the snubbers prevented high amplitude pulsation and rapid acceleration of the gas which is, in great part, responsible for mechanical driving of the pipe line by surging gas. In the plant itself, visual observation disclosed absence of pipe line and equipment vibration as well as related fatigue, which would have been an operating problem without the use of snubbers.

Plastic Pipe Used in Oil Field Installation

PROBLEM: Under Kansas law, all salt water obtained from oil production must be returned deep enough into the ground to prevent any contamination of water which might be used for consumption or irrigation. The pipe used to return the salt water must withstand severely corrosive conditions.

SOLUTION: An oil company on the Esther Jenson lease in Ellis County, Kansas, has installed over three miles of rigid Geon vinyl plastic pipe. The plastic is a product of B. F. Goodrich Chemical Co., and the pipe is made by the Southwestern Plastic Pipe Co., Mineral Wells, Texas. The pipe is laid rapidly by joining sections together with a special cement. One end of the pipe is belled during manufacture so that each length fits snugly into the other and is held in place by the cement. The pipe was laid in extremely cold weather, at temperatures around 11 F., but the cement dried rapidly enough so that installation continued as fast as the construction crew could work.

RESULTS: The rigid vinyl pipe does not corrode. Ditching operations take less time because a perfectly graded ditch is not required. The pipe has greater chemical resistance, dimensional stability, and aging properties than do some other plastic materials used for piping, simplicity of installing, reduced costs by as much as one-third compared to the cost of installing steel pipe. Costs for digging the ditch, installing the pipe or backfilling were about 20% per foot.

...that PATTI PAGE

has got herself ALL HET UP on

S-S-S-S-S STEAM HEAT

And if you're not playin' the heck out of her new hit record you aint bein' loyal to your good old meal ticket—STEAM HEAT!

Hear Patti sing out for "Steam Heat," you Steamcrats . . . and don't tell her how she can get rid of that clank and hiss; it would wreck her sound effects!

We played and played the record at the recent shows and it wowed the steam crowd so much that the warm air boys are said to be working up a song of their own.

In the song Patti says she "puts coal in the boiler," but some listeners (just to make us feel good) said she forgot the main thing—the *water!*

They's so right. There's a McDonnell boiler water level control for every steam boiler—each the best of it's kind. Just set that to music and sing it the livelong day!

McDONNELL & MILLER, Inc. 3500 N. Spaulding Ave., Chicago 18, Ill.

STEAM HEAT

MERCURY RECORDS #70380—70380x45

Written by Richard Adler and Jerry Ross from "The Pajama Game", starring John Raitt, Janis Paige and Eddie Foy, Jr.

McDONNELL *Boiler Water Level Controls*

Experience is my Classroom

By T. W. REYNOLDS

• FLOODED BOILER CONDITION

A reader has trouble due to a flooded condition in one of two identical stoker-fired boilers—the one farthest removed from the chimney. Boilers are identical in size, as illustrated in Fig. 1, are equipped with safety loops,

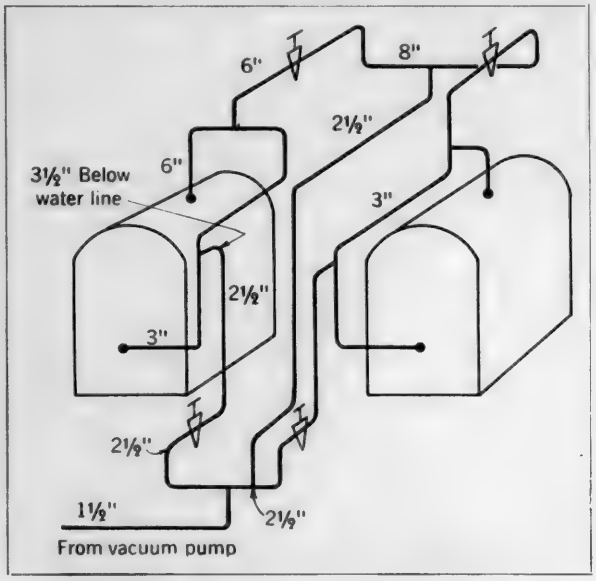


Fig. 1. Trouble developed from unequal water line.

connected to a vacuum pump, and operate jointly. By means of a pressure controller operating from the steam pressure in a common header, the stokers start and stop simultaneously. Each boiler has a combustion control operating from the combustion chamber to maintain constant draft in the chamber.

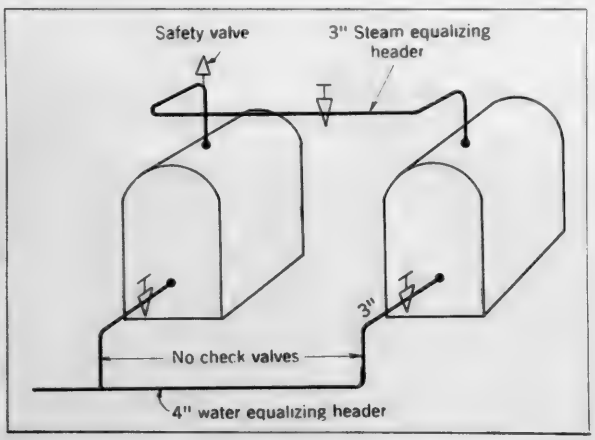


Fig. 2. Solution to problem.

The difficulty, as related, is due mainly to lower pressure in the boiler having less draft from the chimney, since it is farther away. Stokers may stop simultaneously, but fires keep on burning. Furthermore, the so-called equalizer from the steam header is in reality only a drain and is connected where the weight of steam flowing produces a drop in boiler pressure. Pressures in the steam header are unbalanced, even as they are in the boilers.

What is needed is an ample size water equalizing header, Fig. 2, and a steam equalizing header direct from boiler to boiler with no supply branches from it. The safety loops should be removed as the pump is apt to inject in them, although if the pump is set for more frequent operation, there will be less trouble in this respect. As now arranged either boiler can lose water down to the inside bottom of the connection to the safety loop, that is, 3½ inches as set plus 2¼ inches for the pipe, or 5¾ inches all together.

• NON-EQUALIZATION BETWEEN BOILERS

Some causes of differences in water line of two boilers, when oil fired, may be due to oil being delivered somewhat colder to one of the boilers, or to oil burner nozzles not calibrated for equal flow. Some installers try to synchronize the pressurestats to come on or go off at the same time. This is hard to achieve, especially as the system ages, and it is better to have but one burner on at a time. Since there is less stack loss with a smaller fire, there is more economy all around.

Another factor said to cause fluctuation of boiler water lines is that the boiler which steams first has a lot of light steam bubbles at its evaporating surface, hence to equalize the weight of water in one boiler with that of the other, the water line in the steaming boiler must be higher than in the other boiler. If there is a hot water coil in one boiler, it is quite apt to condense all steam as formed in this boiler while the other boiler steams and thereby contains lighter water. The boiler with the coil may be set for operation by aquastat control for 180F boiler water, while the other boiler may be controlled for operation at 5 lb steam pressure. Such a method will also cause inequality of any two boiler water lines.

Of course, one may experience trouble where the boilers are of dissimilar size, because steaming rates will not be the same. Trouble is apt to occur with flash boilers or quick steamers which have a small water content and tend to throw water over, or with one boiler used for heating, the other for incineration, especially so if the heating boiler is irregularly fired at varying rates with a stoker. Trouble may also be experienced where automatic feeders are used or low water cut-offs stop the burner. These de-

(*Concluded on page* 141)

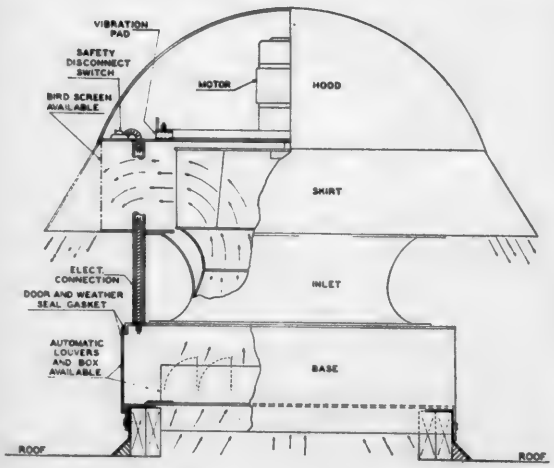
NEW! POWER ROOF VENTILATOR

NON OVERLOADING CENTRIFUGAL TYPE

This Assembly Aerodynamically Designed. Centrifugal Type, Low Smooth Silhouette.

★ QUIET OPERATION ★ BELT or DIRECT DRIVE

★ AVAILABLE IN STEEL - ALUMINUM - COPPER GALVANIZED ★ LOWER POWER CONSUMPTION



★ **"CERTIFIED RATINGS BASED ON N.A.F.M. TESTING PROCEDURE."**

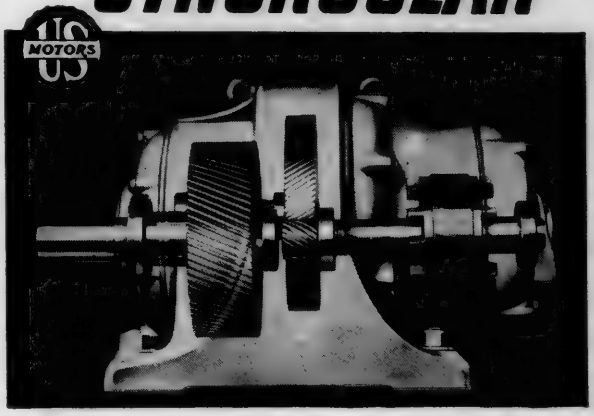
WRITE FOR BULLETIN CRV-101
8622 FERRIS ST., MORTON GROVE, ILL.

"LUNGS FOR INDUSTRY"

GENERAL BLOWER CO.

PLANT & GENERAL OFFICES • MORTON GROVE, ILL.
SALES OFFICES IN PRINCIPAL CITIES

Geared Power SIMPLIFIED WITH SYNCROGEAR



The motor that internally gears its speed

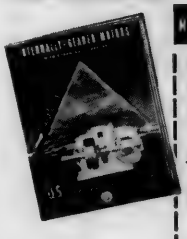
DON'T go to the expense of installing a gear box with extra coupling and guards to rig up slow speed for a motor. Install the *U.S. Syncrogear motor* and avoid extra contraptions. You'll simplify your power hook-up, save space, eliminate hazards and give your driven machine the most efficient power. The U.S. Syncrogear motor was one of the first complete integral power units, introduced 22 years ago. It's backed by experience, tested and proved performance and engineering "know-how" that only U.S. MOTORS can offer to those seeking the most dependable geared motor power.

SYNCROGEAR ADVANTAGES

Compact—rugged—quiet
No external gear box
No extra coupling
Internally-geared
Single unit on one base
Completely housed
Reduced frictional losses
Permanently-aligned parts
Super-hardened gears
Pyramidal supporting base
Solid shank pinion
Normalized castings
Extra large oil reservoir
Asbestos-protected windings
In-a-line shaft
Neat, streamline appearance
Drip-proof surface

U.S. SYNCROGEAR MOTOR

4 TO 10,000 RPM. 1/4 TO 30 H.P.



REQUEST FOR SYNCROGEAR MOTOR BOOKLET

U. S. ELECTRICAL MOTORS INC. HV-8
Box 2058, Los Angeles 54, Calif.
or Milford, Conn.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE___ STATE_____

NEWS OF THE MONTH

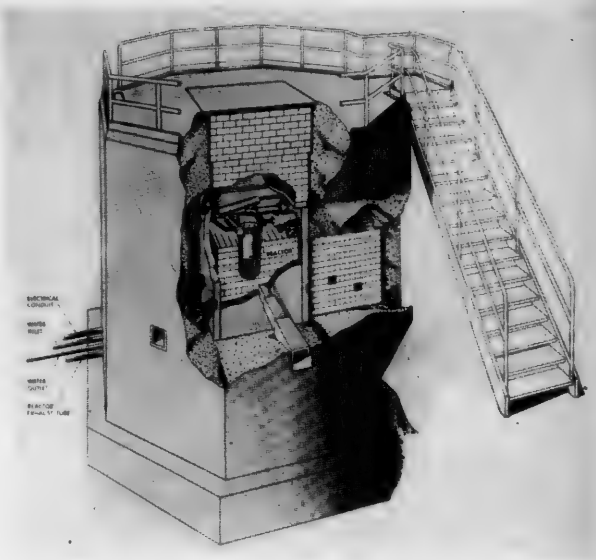
ATOMIC REACTORS

at a firm price are available for use in training and research. Units are modifications of AEC reactors.

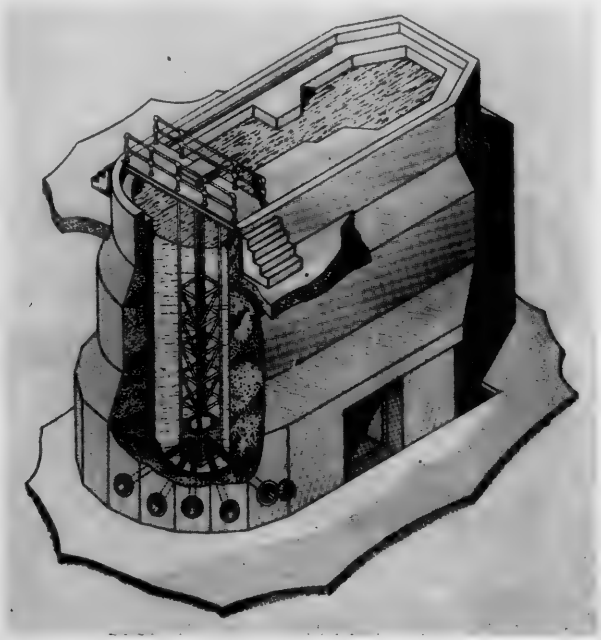
Two relatively low-cost atomic research reactors, adapted for use in training badly needed personnel for the nuclear power industry, as well as for conducting basic nuclear research and development, have been placed on the market by the Atomic Energy Division of Babcock and Wilcox Co. The designs are modified versions of the declassified water boiler and swimming pool reactors developed at Los Alamos, Oak Ridge and the other installations of the Atomic Energy Commission. The units are slated to sell at a firm price, depending upon specifications and installation problems, somewhere in the range of $100,000 to $150,000.

• **PURPOSE.**—Mr. C. H. Gay, vice president in charge of the Atomic Energy Division, observes that the colleges and universities do not have the proper facilities at present, to train men to fill the future requirements of the nuclear field, which he estimates to be around 6000 men in eight years if AEC restrictions on private industry are lifted. In addition, Mr. Gay points out that the colleges and universities must bear a large amount of the research that lies ahead in the field of atomic energy, in spite of the fact that many of our advanced schools are handicapped by the necessity for operating on relatively low budgets. It is with these thoughts in mind that the new reactors are being offered.

• **USES.**—The two reactor units have been designed for a wide number of uses. Both are useful in neutron experiments, radiation chemistry, biological research, radioisotope production and materials development, in addition to their value in engineering education. The swimming pool reactor will probably cost more than the water boiler reactor, but will also offer certain advantages such as space for bulk shielding and similar experiments, which the water boiler reactor does not provide. On the other hand, the water boiler has been designed to obtain the highest possible neutron flux per dollar invested.



Water boiler reactor.



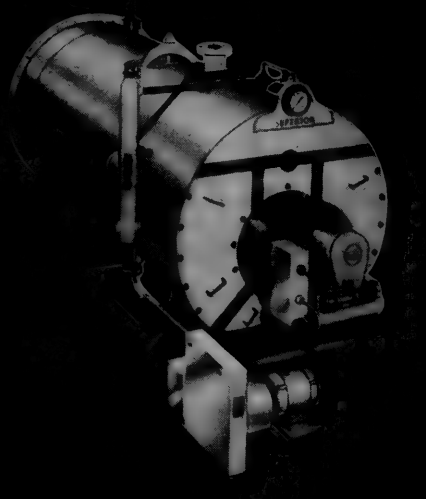
Swimming pool reactor.

• **DESCRIPTION.**—The outstanding characteristic of the swimming pool reactor is its high degree of flexibility. This reactor is a modified version of the Oak Ridge Shielding Facility reactor. Its maximum power is about 1000 kw. The pool is approximately 10 x 20 x 25 ft., and is ordinarily equipped with eight 6-inch and two 8-inch beam ports. In addition to its standard beam ports, the swimming pool reactor usually incorporates three pneumatic tubes for fast experiments. Provision is made for inclusion of special ports and experimental tubes in a number of different arrangements. At full power, the core is cooled by recirculating pool water through a heat exchanger at the rate of 1000 gpm. The pool water is continuously deionized to prevent build up of radioactivity and, in the event of a power failure, the inlet header will automatically disengage to permit natural convection cooling. The shield is constructed of high density concrete.

The water boiler reactor uses a solution of enriched uranium sulfate in water as a fuel and moderator, and a separate cooling system of unique design. Its rated power is from 200 to 400 kw, but it can be operated at any power below this level. The uranium sulphate solution is contained in the lower half of a cylindrical vessel with spherical bottom. Boron controls and safety rods extend down into the core from above. The core is located in the center of a graphite reflector which, in turn, is surrounded by a 4-inch carbon steel thermal shield. A

(*Continued on page* 130)

a PROMISE of PERFORMANCE



Look at a Superior Steam Generator. Compare it with any other on the market. In the clean lines of its integrated design you'll see the promise of performance. Then talk to your Superior Sales Engineer. He has the facts and figures to show how Superior has fulfilled this promise.

Write today for Catalog 619 and the name of your nearest Superior Sales Engineer.

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR
STEAM GENERATORS

ATOMIC REACTORS

(*Continued from page* 128)

5-foot extension of the graphite reflector on one side serves as a thermal column. The pressure above the fuel solution is maintained at negative six inches of water as a safety feature in order that any leakage will be into the reactor gas system rather than out into the reactor room. Hydrogen and oxygen gases created by fission-induced disassociation of the water in the fuel solution are diluted with helium to keep the concentration well below the danger point and are then recombined in a catalyst bed and returned through a closed loop to the core. The cooling system comprises U-shaped stainless steel cooling tubes placed so that they dip down into all parts of the fuel solution and maintain the fuel temperature at a constant level below the boiling point. The coolant is ordinary water. The reactor and its components are contained in an octagonal, high density concrete shield. Aluminum exposure ports extend to the core or reflector from all shield faces, and two ports are located in the thermal column. The air space within the shield is maintained at a slightly negative pressure as a secondary safety feature. The water boiler reactor produces strong collimated beams of both thermal and mixed neutrons for neutron velocity-selectors and other experimental use. Large through-hole facilities with fairly high fluxes can be provided for engineering physics and irradiation experiments.

• **PROSPECTS.**—The company believes that as far as cost is concerned, the most significant advance is that a firm price may be offered on both the manufacture and installation of either reactor. In addition, John W. Landis, a nuclear engineer of the company, stated a belief that every large university and college in this country will eventually have a research reactor as standard laboratory equipment. He pointed out, however, that governmental approval is required before any institution can go ahead with a program of construction of one of these reactors for either research or radioisotope production.

HOME AIR CONDITIONING

advanced in three new housing projects which include year-round air conditioning in initial construction.

A trend towards an increase in residential air conditioning is reflected in the inclusion of year-round equipment as standard equipment in several large new housing developments. The houses, ranging in price from $11,000 to $35,000 all have air conditioning designed right into the structure.

• **PHOENIX.**—Arizona's first home development featuring complete central system refrigerated air conditioning opened recently, with the display of the Hallcraft Weathermaker Home, first in a tract of 40 three-bedroom houses priced at $11,000. The air conditioning was designed by the engineers of Carrier Corp., and installed by Scott Sheet Metal Co. The new smaller version of the Weathermaker system heats with gas and cools by electrical refrigeration, although the unit occupies only a square yard of floor space in the house. Ducts leading from the unit bring air of desired temperature thermostatically controlled to every room of the six-room 1¾ bath home. Additional features provide for dehumidification of air, removal of dust, dirt pollen and airborne insects by a filter system, and draft-free circulation. Cooling capacity is 2 tons.

• **DETROIT.**—Another large scale residential air conditioning installation is sixty-one new homes being constructed in suburban Oak Park, Detroit which will include Chrysler Airtemp year round air conditioning. The development is this area's first large-scale realty venture to specifiy air conditioning as standard equipment in every home. Already, 27 oil-fired winter air conditioners with two or three horsepower water-cooled summer air conditioners are ordered for the first section of the program, consisting of 27 homes. The homes are expected to sell for $25,000 to $35,000, including air conditioning. The builders feel that by including air conditioning in the preliminary building design, it is possible to incorporate many innovations which not only cut down installation costs, but will insure ideal indoor climate at relatively low cost to the occupants. Air distribution will be handled through a diffusing low-wall register perimeter outlet system.

• **LAS VEGAS.**—At Twin Lakes Village, 3½ miles from downtown Las Vegas, a multi-million dollar, medium priced housing development is including year-round air conditioning as a pre-installed feature in homes costing about $11,250. The Spotaire air conditioning system designed by Drayer-Hanson Inc. is being installed as standard equipment in each of the homes. The system requires little ductwork. Simple piping connects to a remotely located refrigeration compressor and boiler to compact individual fan and coil units. These units are placed in a small area above the dropped ceiling or in a hallway or closet. They require no floor space, and the placement of the compressor well out of the living area contributes to quiet operation. Each unit has a thermostat and 3-speed switch which control the temperature in its specific zone. Thus, the home owner may air condition only the living area in the daytime and only the sleeping area at night. This greatly reduces operating costs.

NORTHLAND CENTER

has biggest commercial cooling machines in central station. Chilled water to be metered to customers.

What are believed to be the largest cooling machines ever produced for commercial building air conditioning have gone into action at the new Northland Center super shopping center in Detroit. Manufactured by Carrier Corp., each machine provides 1,800 tons of refrigerating capacity. The two machines together will handle all cooling requirements for the J. L. Hudson Co. department store and the additional buildings currently completed.

(*Continued on page* 132)

For removing a LARGE VOLUME of Fumes or Air at HIGH VELOCITY

allen

VERTICAL DISCHARGE FAN

Whenever you face the problem of discharging fumes or vapors through a roof ventilator so that they will not short circuit back through building openings, you'll find the solution in this new Vertical Discharge Fan. It is designed especially for industrial applications that require the removal of a large volume at high velocity. The "VD" roof fan is fabricated of zinc-coated iron sheet with welded construction throughout. Automatic wing dampers open with air blast, close weathertight when not operating. The "VD" is available as direct drive with motor mounted inside air stream or as "VDR" with motor mounted outside throat of ventilator. Either type is available in a wide range of capacities and sizes.

Write for catalog on complete line of roof ventilators.

ALLEN ENGINEERED VENTILATION

ALLEN COOLER & VENTILATOR INC.
ROCHESTER, MICH.

Roof Ventilators for Every Commercial and Industrial Need

AUTOMATIC D HEATING

YOU can successfully sell COMMERCIAL and INDUSTRIAL Heating!

Even if you have never sold commercial or industrial heating before . . . you can do it now . . . with no increase in overhead and no change in your current operation!

Now you can get in on BIG PROFITS with the World's First

Delta DIRECT-FIRED OIL UNIT HEATER*

Delta has designed an entirely new heating system, available in 10 sizes from 112,000 to 220,000 BTU/hr for wide open spaces and large buildings — that any dealer can install in a few hours.

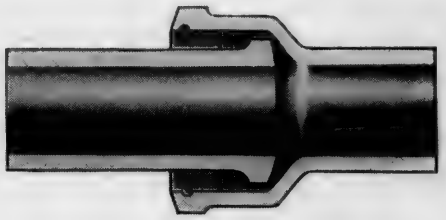
To learn how easy it is to cash in on commercial heating, write for complete details.

*Patents Pending

DELTA HEATING CORPORATION, TRENTON 8, NEW JERSEY

Just remember that

Duriron Acidproof Drain Pipe



is installed by ordinary plumbing methods and

resists corrosion throughout the entire thickness of the pipe wall

Duriron, a high silicon iron alloy, is extremely resistant to most industrial and commercial corrosives—and resists abrasion and erosion, too. This resistance is not just "skin deep," but exists throughout the entire thickness of the pipe wall. That's why Duriron can be expected to outlast the building in which it is installed. Duriron pipe and fittings are available from stock in principal cities. Free Bulletin PF/4 gives complete details.

THE DURIRON COMPANY, Inc.
402 North Findlay St.
DAYTON 1, OHIO

DURIRON
LOOK FOR THE NAME ON EVERY PIECE

DOWN-DRAFT VIEW
Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.
UP-DRAFT VIEW
Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.
field
"MG" Draft Controls
ENGINEERED SPECIFICALLY FOR
GAS
fired industrial and commercial plants
1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provides simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings reacting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases — resulting in greatly increased life.
The Field "MG" has met the most rigid municipal requirements for commercial and industrial installations. It is being used with full approval of the nation's leading gas companies in the nation's largest cities. Fully safe, fully proven, it provides for gas-fired installations the same accurate, dependable performance, the fuel economy so long provided by Field Draft Controls for oil and coal fired furnaces. Write for complete information.
FIELD CONTROL DIVISION
of H. D. Conkey & Company — Mendota, Illinois
AFFILIATES: Conco Building Products, Inc. — Brick, Tile, Stone
Conco Materials Handling Division — Cranes, Hoists

NORTHLAND CENTER

(*Continued from page* 130)

Chilled water from the central power house where the cooling machines are located will be piped underground at a rate of some 10 million gallons a day to all of the buildings in the Center and will be paid for on a meter basis. The system can handle twice that volume of flow to service future buildings.

• **AIR SYSTEM.**—In addition, Carrier has installed one of the nation's larger high-pressure overhead conditioned air distribution systems for the J. L. Hudson store. Nearly eight miles of high-velocity ductwork has been installed to handle the first two floors of the store. The third floor, containing customer and employee cafeterias, beauty shop, hospital and training areas, uses a system which permits occupants to dial their own weather. Altogether, 420,000 cubic feet of conditioned air will be sped every minute from 14 large air conditioning units in a rooftop penthouse to provide comfort throughout the store's 450,000 square feet of area. Other stores will be served by another 500,000 cubic feet of air a minute, conditioned by central station apparatus in each of the buildings.

• **METER.**—The charge for the amount of cooling used by each building will be determined by a new type of meter, specially designed and built for this system at a cost of about $2,000 per meter. These devices will measure a unit of cooling called a therm, which is the equivalent of 100,000 Btu.

All air conditioning units may be started and stopped from a central panel in the power house, but also have push button controls in the basement of each individual building.

75th YEAR

marked by N. J. manufacturer of heating, ventilating and combustion equipment.

L. J. Wing Mfg. Co., of Linden, N. J., manufacturers of heating, ventilating and combustion equipment and steam turbines, was founded in New York City in 1879, and is currently celebrating its 75th continuous year in business.

While the present management is largely responsible for the expansion of the company's activities during the last quarter-century, the company itself stems from the activities of a well-known inventor of the last century, L. J. Wing, an ingenious Yankee who built steam engines, gas generators, marine and stationary gas engines and whose pioneering work is responsible for much of the present day development in the heating and ventilating fields, the company's first product being the Wing disc fan with individually adjustable blades.

Mr. Wing's first business activities started in the late 1870's in various locations in New York City. In 1903, the present L. J. Wing Mfg. Co. was incorporated, being preceded by other unincorporated companies bearing his name.

Mr. Wing's work in the early days centered around the

(*Continued on page* 134)

HEATING AND VENTILATING'S

Ad-Digest SERVICE

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

NOTE: While every attempt is made to list all advertisements, those which are received after the published closing date may not appear. The Index of Advertisers lists all the advertisements in this issue.

BLOWER EQUIPMENT. Page 62. This company's blower equipment helps provide country-fresh conditioned air for Greyhound's unique new Chicago depot. The company's equipment in this building includes 22 fans, 9 air conditioning units, utility sets and axial-flow fans. Air handling equipment was installed in the top levels, rather than in the basement. Information available. .....Item 201

COPPER TUBING. Page 57. Use this company's copper tube in your next radiant heating installation, and you'll do a quality job better and faster. And since this copper tube comes in long length coils, you reduce the number of joints and save the cost of many fittings. And the joints you do make are leak-proof and as strong as tube itself. Information available. .....Item 202

STEAM GENERATOR. Page 129. Look at this company's steam generator. Compare it with any other on the market. In the clean lines of its integrated design you'll see the promise of performance. Then talk to this company's sales engineer. He has the facts and figures to show how the company has fulfilled this promise. Catalog available. .....Item 203

INDUSTRIAL HEATERS. Page 36. These rugged, quiet industrial heaters are designed for continuous heavy-duty systems. They supply ideal heat under difficult conditions. In plant, warehouse, garage and similar buildings, these heaters efficiently blanket large work zones, even those with high ceilings, frequently opened doors and expansive window areas. Information available. .....Item 204

TRAP MECHANISM. Inside front cover. Here's a trap mechanism for low pressures that is identical in design, materials and workmanship to that used in traps for pressures to 950 lbs. and temperatures to 900 degrees F. You know that it will last a long time with an absolute minimum of maintenance on a low pressure heating system. Mass production of traps for all pressures makes it possible to deliver this mechanism at no premium in price. Catalog available. .....Item 205

DIRECT FIRED HEATER. Page 144. This 2 million Btu per hour direct-fired heater is a brand new profit maker for heating contractors. Its fast selling features include: ease of installation, small space consumption, heats up to approximately 24,000 square feet, and it circulates an even blanket of heat directly at working level or through air ducts. Bulletin available. .....Item 206

DUCT LINER AND INSULATOR. Page 51. This company's duct liner is a soft, light weight, manageable glass fiber insulating material with excellent acoustical and thermal properties, and represents another achievement in this company's electronic-extrusion process, which makes possible the long, uniform fibers responsible for the insulating and mechanical superiorities of this new duct liner. Technical bulletin and sample available. .....Item 207

COOLING TOWER. Page 133. This company's cooling tower has more capacity because the redistributing decks keep the water uniformly suspended, providing maximum contact between air and water. Casing and sump are of heavy gage steel, hot dip galvanized after fabrication. Unit is shipped assembled but can be knocked down to eliminate rigging costs. 3 to 8 ton capacities. .....Item 208

AIR FILTER GAGE. Page 137. This company's air filter gage provides a visual check of filter efficiency on any system. Determines exact filter efficiency the only practical and economical way: via pressure drop. The low first cost is repaid over and over through savings in replacement and service time, plus maintained optimum filter efficiency. Catalog available. .....Item 209

STEEL PIPE. Page 46. So dependable is this company's steel pipe, that architects and contractors have been specifying it for over 60 years as the standard for conventional plumbing and heating systems. They know that this pipe has the inherent characteristics necessary to meet the requirements of such applications. Information available. .....Item 210

LIQUID DEPTH GAGES. Page 135. This company's remote reading liquid depth gages bring your liquid level to eye level. The best gage for commercial and industrial fuel oil storage tanks, domestic installations with buried tanks, storage tanks for other industrial liquids, i.e.: gasoline, solvents, acids, etc. Bulletin available. .....Item 211

COAL FOR INDUSTRIAL PLANTS. Page 111. Discover for yourself the great advantages of coal burned in the modern way. Call in a consulting engineer. He'll show you how today's combustion equipment can give you 10% to 40% more power from a ton of bituminous coal than from equipment used only a few years ago. He'll show you how modern labor-saving coal and ash-handling equipment make a coal-fired installation clean, convenient, and dust free. Information available. Item 212

INSULATED PIPING SYSTEMS. Page 44. A never ending line of quality. This company represents over 40 years of manufacturing quality insulated piping systems. The complete line is continuously pre-proven by laboratory and field tests to maintain this superior quality. Information available. .....Item 213

HEATING EQUIPMENT. Page 32. This company's field representation puts the services of all these men at your disposal; a division sales manager; a district sales representative; and a traveling, three-man, sales-training and service team consisting of a heating product specialist; an air conditioning specialist; and a merchandising specialist. Information available. .....Item 214

COOLING TOWERS. Page 113. Constantly wetted wood decking in a cooling tower is subject to immediate attack by fungus and marine parasites. It is also subject to chemical deterioration from acids in water. All wood used in this company's cooling towers is protected against these twin enemies. Creosote, with 162 elements toxic to fungus growth and parasites, also makes wood more resistant to chemical attack. Information available. .....Item 215

REMOTE ROOM AIR CONDITIONING UNITS. Page 48. This company's remote room units operate at absolute minimum noise level for peaceful, undisturbed comfort. Designed and built with silence in mind. These units are the most practical answer to the problem of air conditioning hotels, motels, offices and other areas in which quiet operation is essential. Information available. .....Item 216

AUTOMATIC HEATING SYSTEM CONTROL. Page 29. Now you can cash in on big new profits in the hot water heating field with this company's new indoor-outdoor control for forced hot-water heating systems. That's because this control offers heating comfort never before possible in forced hot water heating systems, consistently uniform and completely automatic. Bulletin available. .....Item 217

COPPER TUBING. Page 41. This company is dedicated to supplying your copper tube needs with a product of dependable, uniform quality. In one of America's largest, completely integrated mills, specializing in the processing of copper tube from basic metal to finished tubing, this copper tube is produced with the newest, most modern equipment known to metallurgical science. Information available. .....Item 218

Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

PLEASE SEND US MORE INFORMATION

Circle below item numbers on which you wish further information.

201	202	203	204	205	206	207	208	209	210	211	212	213	214
215	216	217	218	219	220	221	222	223	224	225	226	227	228
229	230	231	232	233	234	235	236	237	238	239	240	241	242
243	244	245	246	247	248	249	250	251	252	253	254	255	256
257	258	259	260	261	262	263	264	265	266	267	268	269	270
271	272	273	274	275	276	277	278	279	280	281	282	283	284
285	286	287	288	289	290	291	292						

PLEASE PRINT Aug. AD-54

This service available only to U. S. and Canadian readers

Name..... Title.....

Firm .....

Nature of Firm's Business.....

Street .....

City..... Zone..... State.....

This card is void after Nov. 1, 1954

SERVICE

AIR CONDITIONING EQUIPMENT. Inside back cover. Harris County boasts two new court houses at Houston. This company's equipment installed in both. The amount of this company's equipment selected for these two installations is impressive. You, too, will find it makes sense to choose this company's dependable equipment. Service manual available. ----------Item 219

HEATING AND VENTILATING UNITS. Page 146. This company's heating and ventilating units offer the most economical method of heating and ventilating large areas in factories, warehouses, garages, hangars, commercial and industrial buildings. In three sectional types, six basic sizes each, with either right or left hand coil connections, they afford a flexibility for meeting any steam or hot water installation and capacity requirement. Information and selection data available. ----------Item 220

2-STAGE CONDENSING UNITS. Page 7. Now, with these 2-stage units, you can easily handle, with one unit, many low temperature applications that formerly required hook-ups of two or more condensing units. These units are ideal for use in cold test chambers, frozen food, metal processing and other jobs where sub-zero temperatures are desired. Saves time and dollars on installation and maintenance costs, too. Specifications available. ----------Item 221

MOTOR CONTROLS. Page 63. This company's automatic starters are popular for refrigeration and air conditioning service because they are trouble free. This is due to only one moving part. No pivots, pins or bearings to corrode or stick. No jumpers to break. You install them, and forget them. Information available. ----Item 222

DRAIN PIPE. Page 131. This company's acidproof drain pipe is installed by ordinary plumbing methods and resists corrosion throughout the entire thickness of the pipe wall. Made of a high silicon alloy, it is extremely resistant to most industrial and commercial corrosives. Bulletin available. ----------Item 223

FREON COOLERS. Page 117. The air conditioning system of the National State Bank in Jersey, is regarded as a sound, long term investment in business efficiency. This company's Freon coolers are an integral part of this system. Two of the coolers provide a total capacity of 125 tons of refrigeration cooling water at the rate of 300 gpm from 52 to 42 degrees F. Even at ⅓ total capacity, proper gas velocities are maintained for efficient operation. Literature or engineering help available. ----------Item 224

ter than 1 per minute instead of an estimated 15 minutes each by conventional methods. Tool was used in hanging 13 miles of sprinkler piping as well as 43 miles of electric conduit. Information available. ----------Item 225

AIR CONDITIONERS. Page 14. Ceiling model air conditioners feature hermetically sealed compressor, throwaway filters, easy installation and easy service for residential and commercial use ideal for attic installation. Horizontal unit can be attached to existing warm air duct work or used as a self-contained unit for free discharge. Exceeds rated capacities in 2 and 3 ton sizes with or without blower. Item 226

PUMPS. Page 47. If you're interested in reducing installation and maintenance cost don't overlook this line of depenable pumps which include vacuum pumps, condensate pumps, turbine pumps, and vertical pumps. They are built compactly and are easily installed whether for below floor level returns or in cramped quarters. ----------Item 227

DUCT CONNECTOR. Page 133. A one piece fabric and metal duct connector preassembled makes quality flexible ducts up to 70% faster than older methods. Wide metal edges are ample to form all types of joints. Stops vibration noise in furnaces, blowers, air conditioners or attic fans. Stapler eliminates costly sewing of fabric. Available in canvas, asbestos or neoprened fiberglas. Literature available.----Item 228

CHILLERS. Page 149. Controlled velocity chillers with improved heat transfer, no oil logging or slop over, and rapid response to thermal expansion valves. Full details and application data available.----Item 229

DIAL THERMOMETERS. Page 137. These thermometers are made in 3 types—rigid stem, wall-mounted, and flush-mounted to meet all requirements. Technical bulletin available. ----------Item 230

COPPER TUBE. Page 130. A large contracting firm in Baltimore has over 10,000 satisfied home owners attesting to the qualities of this line of copper water tube, preferred because it is easy to bend, comes in handy lengths, will take solder or compression fittings, and is non-rusting. Technical advisory service available. Item 231

ROOF VENTILATORS. Page 136. These ventilators are streamlined, propeller driven, roof mounted, with motor out of air stream and easy to install. Available in 15 sizes from 254 to 10280 cfm. Information available. ----------Item 232

CONDENSATE PUMPS. Page 119. Condensate pumps in capacities from 500 to 10,000 sq. ft. E.D.R., available in both single and duplex units. Technical bulletin available. ----------Item 233

EVAPORATIVE CONDENSER. Page 118. Evaporative condensers that eliminate waste-water disposal problems and pumping costs. Engineered to give maximum efficiency and performance at a reasonable cost. Available in sizes from 3 to 100 tons. Information available.----Item 234

sure perfectly even air motion and exceptional uniformity and control of room temperatures. Information available. ----------Item 235

HEAT TRANSFER EQUIPMENT. Page 119. This company's line of air conditioning and refrigeration equipment includes such items as evaporators, condensers, brine coolers, water chillers, receivers. Company carries special designs for process industries, and its engineers have been designing general heat exchange apparatus for almost a half a century. There is no substitute for experience. Information available. ----------Item 236

COOLING TOWERS. Page 115. Cooling tower of this line installed just a few feet from guest rooms in North Carolina hotel. No one has complained or lost a wink of sleep due to very quiet operation. Features controlled air movement which makes units independent of natural breezes, and squirrel cage blowers which provide quiet operation even at slow speeds. Comes in several tonnages. Bulletins available. ----------Item 237

CONTROLLED HUMIDITY. Page 124. A new, more reliable air conditioning method with exact moisture control for your process or protection for testing products or materials at any time of the year. Bulletins available. ----------Item 238

AIR CONDITIONING UNITS. Page 61. Low ceilings cannot be furred down to hide the duct work necessary for most air conditioning systems. However, this company's system does not require bulky ducts. One pipe carries chilled or hot water from a centrally located plant to each individually controlled unit in a building. These units condition the air through 4-row coils, and circulate it through the room. Information available. ----------Item 239

FIRE PROTECTION EQUIPMENT. Page 133. This company's line of interior fire proection equipment includes 480 cabinets alone. This equipment is proved reliable, economical, easy to install and generally best for clients. Information available. ----------Item 240

AIR CONDITIONING AND REFRIGERATION. Page 24. A fine Indiana building, containing apartments, guest rooms, dining halls, shops and swimming pools has both air conditioning and food service loads handled by 13 of this company's refrigerating machines and a unit air conditioner. Seven fractional-horsepower units serve food-dispensing equipment while four of 7½ hp each cool a dozen walk-in boxes. Bulletin available. ----------Item 241

GAS ANALYZER. Page 123. The first of its type developed for field work, this company's gas analyzer answers the need for an analyzer husky enough for use in the boiler room and for installation and service work in commercial and home heating plants, yet simple, fast, and accurate. Available in one, two or three unit styles. Does a complete testing job for CO_2, O_2 and CO in three minutes. Publication available. ----------Item 242

STEEL BOILERS. Page 45. These boilers are available in sizes from 129 to 2500 square feet of heating surface. The compact design makes them particularly adaptable to cramped boiler room area. Bulletin available. ----------Item 243

DIRECT FIRED HEATERS. Page 135. Direct fired heaters give heat when and where you need it at the flick of a switch which saves on low initial cost and have fully automatic controls. Available for gas, oil, coal or dual gas and oil. Information available. ----------Item 244

DRAFT CONTROL. Page 132. Draft controls engineered specifically for gas-fired industrial and commercial plants and which meet the most rigid municipal requirements. Information available. ----------Item 245

) Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U. S.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 59, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

HEATING AND VENTILATING
148 LAFAYETTE STREET
NEW YORK 13, N. Y.

D-DIGEST SERVICE

eliminates costly call-backs. This baseboard is specifically designed to eliminate wall-streaking. It provides uniform temperatures between floor and ceiling. Bulletin available. ----------Item 246

BOILER HEATING PRODUCTS. Page 143. For heating systems, whether by hot water or steam, this company's pioneering research and engineering skill have produced protective and controlling devices that make water and heating systems safe, efficient, automatic. This company's manufacturing efficiency and excellent workmanship provide you with quality controls, which enable you to render real service to your customers. Catalog available. ----------Item 247

WELDED BOILER TUBES. Page 15. You get tight joints with this company's welded boiler tubes. A combination of qualities are offered by these electric resistance welded boiler tubes that add up to savings in time, money and labor. The surfaces are free from pits, indentations, mill scratches and similar imperfections. Because of controlled normalizing practice, the surface is protected against formation of detrimental scale. Information available.----------Item 248

GEARED MOTOR. Page 127. An electric motor that internally gears its speed so that the expense of installing a gear box is not needed. Eighteen advantages are listed. Available in sizes from ¼ to 30 hp. Information available. ----------Item 249

STEAM HEATING. Page 39. A high vacuum steam heating system that assures the ultimate in comfort, economy, and convenience. A single dial control tunes in with the weather, balancing heat supply against heat loss. Intended for schools, hospitals, churches, apartments, commercial and public buildings. Bulletin available. ----------Item 250

AIR DIFFUSERS. Page 142. Slender, continuous line diffusers ideal for installation in shallow lighting coves or for air curtaining of glass windows or exposed wall areas. Custom built with the company's patented diffusing vanes. These diffusers fit inconspicuously into your plans. Catalog available. ----------Item 251

FREON COMPRESSOR. Page 25. Years were spent in developing this new Freon compressor of which the features include the trim, sturdy construction, easy removal of gas strainer in the suction line, operating efficiency, and high capacity. Information available. ----------Item 252

VIBRATION CONTROL. Page 122. Case history of the use of this company's vibration control in an office building where 41 pieces of refrigeration equipment were installed in two penthouses. This vibration isolation reduces transmitted vibration and permits installation anywhere in apartment, public and industrial buildings and decreases the original building and foundation costs. Bulletin available.---Item 253

VALVES. Page 22. This company's plug-type disc and seat design make a most effective seating combination for tough steam service. Highly resistant to damage by foreign matter, wire-drawing, erosion, cutting and galling. The wide tapered disc allows fine, accurate throttling. These rugged bronze valves come in globe and angle patterns. Catalog available. Item 254

HEAT TRANSFER EQUIPMENT. Page 53. No floor space required with this company's suspended low-boy unit heater. Fresh, clean, warm air is delivered by a compact high-boy unit with fresh air filtered intake through side wall. Low overhead and high efficiency are characteristics of wall mounted low-boys which provide plenty of heat even where quarters are cramped. Bulletin available. ----------Item 255

PROPELLER FANS. Page 23. Propeller type ventilating fans deliver large volumes of air at low resistance and low current consumption. All wheels are machine-balanced for smooth, vibrationless operation. Made in two types and ten basic sizes to cover a wide range of industrial applications. These pressed steel panels provide rigid support and simplify installation. Bulletin available.----------Item 257

AIR CONDITIONING EQUIPMENT. Page 18. When you handle this company's line, you're ready for practically any profitable job in the field of air conditioning and refrigeration. You're ready to satisfy customers with the industry's top quality equipment line. You're ready to take advantage of this company's national advertising. It makes profit sense to sell this company's line. Information available. ----------Item 258

AIR CONDITIONING SYSTEM. Page 42. This company's air conditioning system with centralized control was selected to supply conditioned air for the new Empress Hotel in Miami Beach. To give guests complete control of temperature in their own rooms a system of individual air conditioning units was employed. These concealed overhead units utilize chilled water in summer and warm water in winter. This company manufactures precision built equipment for all types of air conditioning. Information available. ----------Item 259

UNIT HEATERS. Page 14. This company's automatic, gas-fired unit heater provides quiet, thermostat-controlled heat when and where it is needed. There is no waste fuel in warm-up and stand-by time, no costly boiler room and piping system, and no fuel handling. Imput ratings range from 50,000 to 225,000 Btu. Information available. ----------Item 260

HEATING PUMPS. Page 58. This company's complete line of heating pumps are designed to meet the specific and exacting needs of building service. When you specify this company's heating pumps, you can be certain you will always get the correct pump for the job. Bulletins available. ----------Item 261

HEATING SPECIALTIES. Page 54. These traps are individually and permanently adjusted to close tight on steam, but open promptly and pass air or condensate at temperatures only a few degrees below closing temperature. The part that provides positive operation in this company's radiator traps is the rugged, but sensitive thermostatic diaphragm. Information available. ----------Item 262

INDUSTRIAL UNIT HEATERS. Page 131. You can successfully sell commercial and industrial heating with no increase in overhead and no change in your current operation. This company has designed a new heating system available in 10 sizes from 112,000 to 220,000 Btu per hour for wide open spaces and large buildings. Information available. ----------Item 263

VERTICAL DISCHARGE FAN. Page 131. This vertical discharge fan is designed specially for industrial applications that require the removal of a large volume at high velocity. The fan is available as direct drive with motor mounted inside air stream or with motor mounted outside throat of ventilator. Catalog available. ----------Item 264

VENTILATOR CAP. Page 135. This cap eliminates draft trouble caused by downdrafts, backdrafts, pilot blowouts and condensation. It acts as a spark arrester. It creates even stack temperature. It improves combustion and cuts fuel costs, and will not freeze shut or soot up. It has been field tested four years in all kinds of weather, in every part of the country, with all types of units. Information available. ----------Item 265

WATER CIRCULATORS. Page 59. For real dependability and fine performance choose this company's water circulators. Time-tested design, improved efficiency, increased capacity with job-rated power for each size are features of this circulator. This company offers the greatest value per dollar in circulators today. Information available. ----------Item 266

COPPER TUBES. Page 37. This company's copper tubes are light. They come in long lengths. Smaller sizes are bent right on the job. All this means big savings on installation costs. And, copper tubes cannot rust. They resist corrosion and guard against contamination. Smooth interiors mean smoother flow and pumping costs are often lower. Information available. ----------Item 267

POWER VENTILATORS. Page 141. For fast, localized removal of high heat, smoke, fumes and dust, this company's ventilator does an outstanding job. Its absolute free opening channels air vertically upward at high velocity. Its specially designed axial flow fan provides a high volume of air delivery with efficiency and economy. Seven sizes and 17 motors provide wide flexibility. Bulletin available. ----------Item 268

CONVECTOR RADIATION. Page 132. Superb styling and superb performance are what you get when you specify this company's convector radiation. These beautifully designed convectors have met every test for uniform, healthful heating. For long life and economical service, there is no finer convector built. Bulletin available. ----------Item 269

of HEATING AND VENTILATING, then fill out and mail the prepaid postcard to request further information.

Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

PLEASE SEND US MORE INFORMATION

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285	286	287	288	289	290	291	292						

PLEASE PRINT Aug. AD-54

This service available only to U. S. and Canadian readers

Name..... Title.....

Firm .....

Nature of Firm's Business.....

Street .....

City..... Zone..... State.....

This card is void after Nov. 1, 1954

Ad-Digest SERVICE

PACKAGED AIR CONDITIONERS. Page 58. This company's step by step plan enables your client or customer to cool key areas first. Later, when budget permits, he adds extra packaged units, to cool other areas. These units are priced surprisingly low. Installation costs are low, too. In many applications, no ducts or machinery rooms are required. Information available. ----------Item 270

MODERATOR SYSTEMS. Page 2. This company's moderator system of steam heating varies steam flow automatically with changes in outdoor temperature. Zone variators permit manual regulation of heat delivery for quick warmup and reduced night heating. This company's metering orifices in each convector balance steam distribution to all radiators at the same time. The radiator valves provide individual complete shut off at each radiator. The traps keep radiators free of condensation at all times. Information available. ----------Item 271

PREHEATER. Page 137. This company's preheater preheats fuel oils and other liquids to proper flow temperature before entering the suction line. With this preheater the oil flows more freely at high temperatures and have greater Btu per hour value. This preheater does the preheating job efficiently. It takes the load off the suction pump. Information available. ----------Item 272

SELF-CONTAINED BOILERS. Page 121. Here are basic reasons why this company's self-contained boilers save money wherever installed. They save fuel, space, service, maintenance, expense of special equipment, installation costs, fuel flexibility, quick steaming, manpower, and planning time. It pays to plan from all angles to get greatest boiler economy. Catalog available.----------Item 273

FAN UNITS. Page 38. The design of this company's fans is highly efficient, yielding to a maximum air volume-to-power ratio. Blades are of true airfoil shape, and are readily adjustable for maximum flexibility to meet varying conditions. Thick steel casings are used in the sturdy construction that smothers operating noise. Bulletin available. ----------Item 274

PLUMBING FIXTURES. Page 43. This company's system includes everything except pipe for installing wall-type toilets up to where the horizontal drainage line connects with the stack. Installations are above the floor, behind the toilets and behind the wall. There are no delays waiting for other crafts. Information available. ----------Item 275

AUTOMATIC CONTROLS. Back cover. This company's engineers, working with heating and ventilating engineers, architects, owners and builders, have helped to plan control systems for the nation's outstanding office buildings, schools, hospitals, industrial plants, department stores and public buildings from coast to coast. Let an engineer from a nearby branch office solve your next temperature control problem. Information available. Item 276

AIR FILTERS. Page 143. These filters are designed for an approach velocity of 530 fpm over the net media area. The high filtering efficiency increases as the dust load is applied. Very large dust holding capacity of these filters assures longer service periods, fewer cleanings per year, and lower service charges. Information available. ----------Item 277

BOILERS. Page 26. This company's exclusive design and jet action circulation are responsible for dramatic savings in fuel and water. Fuel requirements are substantially lower than for other boilers of equal capacities, with all types of heating systems, new buildings or old. Information available. ----------Item 278

CONTINUOUS WELD PIPE. Page 51. This company's pipe carries steam for the soot and fly ash in the large boiler in an Ohio electric plant. The service is so severe that regular carbon steel pipe had to be replaced as often as 60 days. A solution for this corrosion problem was obtained by installing this company's pipe. Booklet available. ----------Item 279

MULTI - ROOM AIR CONDITIONING. Pages 20-21. These units mean full unit control in multi-room air conditioning. It's the system that offers the desirable features of a central system, plus individually controlled units that cool or heat, dehumidify, ventilate, filter and circulate air for personalized climate control. Bulletin available. ----------Item 280

VALVES. Page 49. For either one pipe or two pipes, steam, hot water, residential or industrial heating, this company assures the correct vent valve for each specific requirement. For the hard to balance radiators, this line includes adjustable port valves available for vacuum and non-vacuum systems. Information available. ----------Item 281

ROOF VENTILATOR. Page 127. This company's ventilator features such advantages as quiet operation, belt or direct drive, steel construction, aluminum or copper galvanized, and lower power consumption. Bulletin available. ----------Item 282

CONTROLS. Page 17. This company boasts the most complete line of controls made. Devices include controls for forced hot water heating systems, radiant panel heating systems, air conditioning units using chilled and heated water, cooling water for air compressors, Diesel, gas engines, and cyclotrons. Catalog available. Item 283

BOILER WATER CONTROLS. Page 135. This company offers a boiler water level control for every steam boiler, each the best of its kind. Included in its line are feeder controls, low and high water fuel cutoff controls and pressure relief controls. This ad features a record "Steam Heat" by Patti Page which was played at recent shows where it attracted attention. Information available. ----------Item 284

UNIT HEATERS. Page 9. This company's unit heaters remove practically every obstacle to your freedom of design and application in heating offices, show rooms, and corridors. The family of five matched casings ranges in length from 34 to 74½ inches. Heights are 22¾ inches for the small units, and 29 inches for the four large units. For floor mounting a 2-inch base is provided. Publication available. ----------Item 285

ELECTRONIC FILTERS. Page 69. This company's filter is designed for easy installation and trouble free operation. In hermetically sealed power pack, vacuum tubes are replaced by selenium rectifiers. Having no ironizer, the problem of broken ironizer wires is eliminated. Maintenance by unskilled labor, is reduced to the simple, periodic replacement of the filter cells. Information available. ----------Item 286

HEATING SYSTEMS. Page 19. This company's heating system provides individual temperature control for each of nine apartments in a new apartment building. Each tenant can have the temperature considered most comfortable, and raised or lowered at will. When you install this company's hot water system, you've laid the groundwork for the most modern comforts and conveniences. Catalog available. ----------Item 287

HEAT TRANSFER EQUIPMENT. Page 27. These engineered heating coils feature high efficiency coils, long life, and guaranteed rating. Features of these coils are precision extruded fins, mechanically expanded tube-to-fin collar bond, permanent, leak-proof tube-to-header construction. Included among this company's heat transfer equipment are horizontal type unit heaters, cabinet unit heaters, vertical unit heaters, heating and cooling coils, convector radiators, and air conditioning units. Catalog available. ----------Item 288

TEMPERATURE CONTROL SPECIALTIES. Page 31. Whether your needs are for heating, cooling or combination self-contained heating and cooling units for year-round service see how much this company offers in quality, economy, and efficient performance. Priced to sell, this company offers the world's finest heating and cooling products in a complete range of types and sizes. Information available. ----------Item 289

AIR CONDITIONING. Page 55. Architects, building owners, and managers are showing their approval by specifying this company's equipment for more and more buildings, old and new. The Equitable Life Assurance Society Building is an example. This impressive structure is the first large office building in San Francisco to have complete air conditioning. Naturally, the tremendous glass areas of this building presented a sizable heat load problem. This company's low pressure induction unit system was the perfect answer. Information available. ----------Item 290

BOILERS. Page 30. Whatever your fuel, whatever your steam capacity requirements to 60,000 pounds per hour, you will find that one of this company's boilers will be just right for you. This company has two boilers to meet your needs. If you burn oil or gas, investigate the packaged boiler for capacities up to 30,000 pounds per hour. For stoker firing, another boiler is available from 10,000 to 60,000 pounds of steam per hour. Catalogs available.----------Item 291

STEAM GENERATORS. Page 25. This company's steam generator offers savings in first cost. Purchase price includes complete unit. Just set on level concrete floor and connect to service lines and breeching. Because of a minimum of supervision, lower manhour requirements for maintenance, easily replaced inexpensive plastic refractories, and 80% thermal efficiency, savings in operation are also realized. Bulletin available.----------Item 292

Postage Will be paid by Addressee

No Postage Stamp Necessary If Mailed in the U. S.

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 58, SEC. 34.9, P. L. & R., NEW YORK, N. Y.

HEATING AND VENTILATING

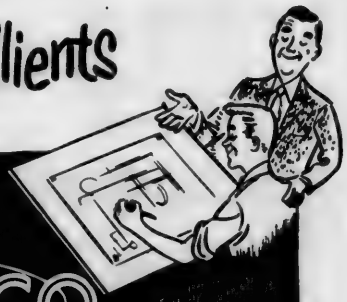
148 LAFAYETTE STREET

NEW YORK 13, N. Y.

AD-DIGEST SERVICE

Best for Clients

PROVED RELIABLE, ECONOMICAL

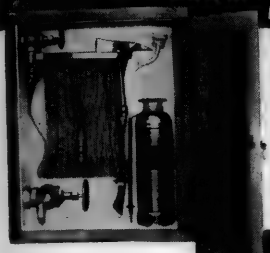


ALLENCO

INTERIOR

FIRE-PROTECTION EQUIPMENT

Complete Line — 480 Cabinets Alone
Modern, Most Widely Used



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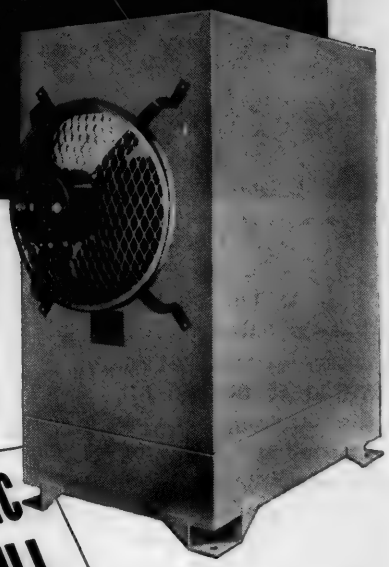
by KRAMER



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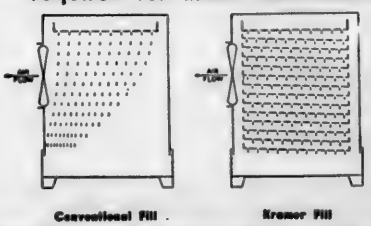
Unit is shipped assembled but can be knocked down to eliminate rigging costs. One fitting required for drain and over-flow.



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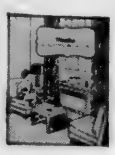

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Niagara District Engineers in Principal Cities of U. S. and Canada

75TH YEAR

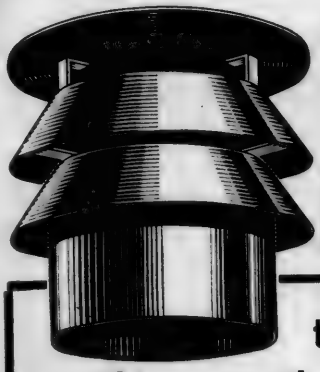
(*Continued from page* 132)

Cover of catalog of Wing products issued in 1880. Inset shows L. J. Wing, founder.

development and construction of propeller type disc fans which were used for ventilation, drying, etc. These were driven in several ways, first by pulleys from line shafting, and, as development progressed, by individual steam engines, first by belt and later by direct connection and also by gas engines and by electric motors, most of which were largely designed and manufactured complete by the Wing company in its own shops.

● **TURBINE DRIVE.**—In 1905 the first individual steam turbine driven fan was introduced by Wing to furnish forced draft for boiler furnaces. This product was the first of its kind in the world. It had an important effect in creating a new conception of how forced draft should be applied in a power plant. Previously most installations consisted of a single system for all boilers. Today, as a result of the individual idea as expressed by introduction of the turbo-blower, hardly a modern plant is erected that does not provide a blower for each boiler.

(*Continued on page* 136)



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ELIMINATES DRAFT TROUBLES **caused by downdrafts, backdrafts, pilot blowouts, condensation. Acts as spark arrester. Creates even stack temperature. Improves combustion and cuts fuel costs. Will not freeze shut or soot up. Field tested four years in all kinds of weather, in every part of the country, with all types of units. Improved features give long life. Available in galvanized steel or aluminum in all popular stack sizes.**

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SAVE on low initial cost, simple installation and efficient operation.

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Storage Tanks for other Industrial Liquids—gasoline, solvents, acids, etc.

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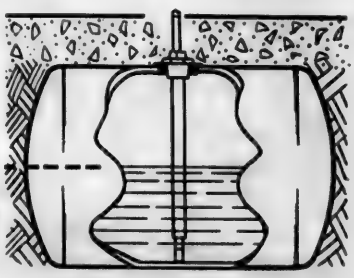

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Muckle MANUFACTURING COMPANY

OWATONNA 3, MINNESOTA

75TH YEAR

(*Continued from page* 134)

The introduction of the turbine blower had another important effect. It represented the first development of the propeller type fan for delivery of air against high static pressure—in other words, a "pressure type" fan.

In 1917 the Wing Co., through the direct efforts of its present president, Harry S. Wheller, first introduced the use of the modern pressure type propeller fan to the United States Navy and an original installation was made on the U. S. S. Kimberley, then building in the Boston Navy Yard.

Immediately following this installation at the close of World War I, over 200 ships were similarly equipped by the Navy with this type of fan. From then on its use was extended through progressive improvements so that today approximately 90% of all Navy fans are of this type.

• **UNIT HEATER.**—In 1920 another basic product was developed by the company, in the form of the lightweight, overhead - suspended and downward discharge unit heater. Many older plants, since the original Wing product was introduced, have been revamped and modernized to take advantage of the added comfort and important fuel savings resulting from use of this type of unit. An exclusive refinement of the lightweight overhead unit heater, which was the invention of H. S. Wheller, was his further invention of the revolving discharge outlet, which has resulted in two great improvements, the uniform distribution of the heated air to all parts of the working area and the improved working atmosphere provided by the gentle air movement.

H. S. Wheller

The present officers of the company are Harry S. Wheller, president and general manager, Walter W. Wilson, vice president and treasurer, and Charles H. Smith, vice president and secretary.

In 1902 Mr. Wheller, the present head of the company, joined the then small company headed by its inventor-founder and was closely associated with Mr. Wing up to the time of his death. Mr. Wheller has served in various executive capacities and was elected president and general manager in 1943.

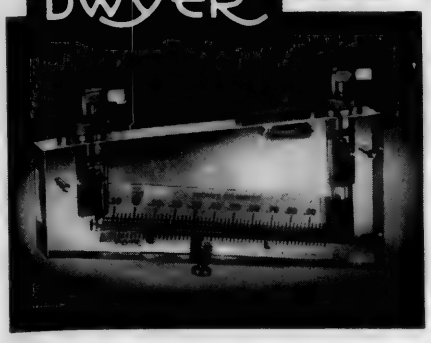
Mr. Wilson joined the company in 1910 and after serving a number of years as secretary and treasurer, in 1943 became vice president and treasurer.

Mr. Smith joined the Wing company in 1920, and as sales engineer, was responsible for much of the development of the combustion equipment manufactured by the company. He was elected secretary in 1943 and vice president in 1952.

Wing products comprise unit heaters, steam, gas or

(*Continued on page* 138)

DWYER AIR FILTER GAGE



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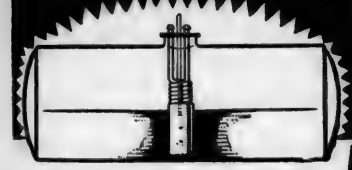

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Preheats fuel oils and other liquids to proper flow temperature before entering the suction line.

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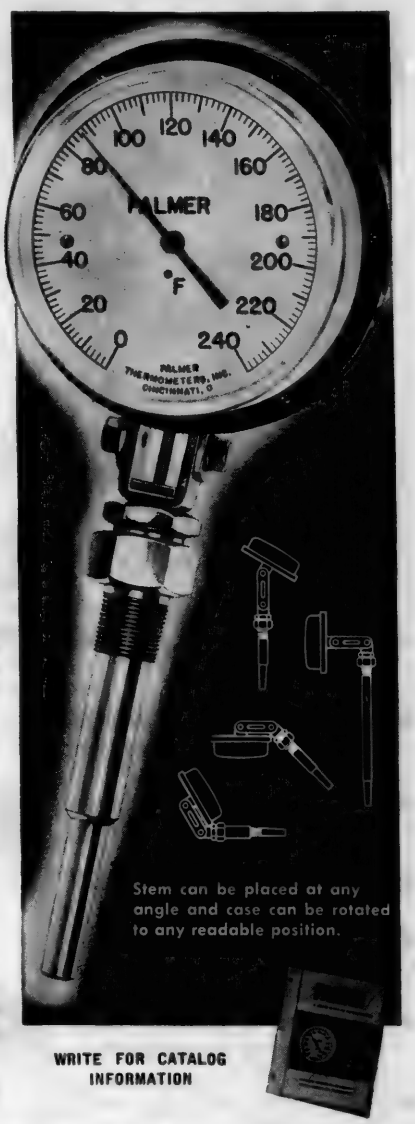
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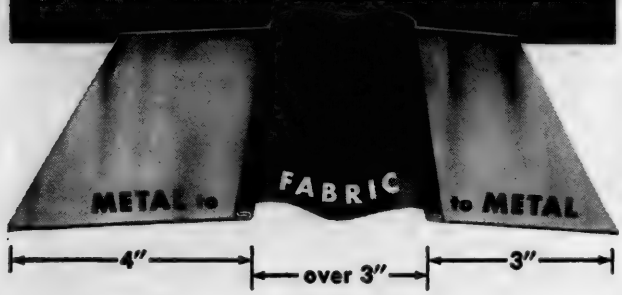

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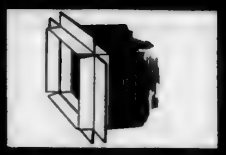
CLINCH COLLAR

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DURO-DYNE CORPORATION
800E Third Ave., New Hyde Park, L. I., N. Y.

75TH YEAR

(*Continued from page* 136)

Eight 84-inch Wingfoil fans at N.A.C.A. Lewis Flight Propulsion Laboratory, Cleveland, Ohio. Each fan has a capacity of 75,000 cfm forward flow at 6-inch static pressure and 52,550 cfm reverse flow at 3½-inch static pressure.

electric types, with fixed or revolving discharge outlets; fresh air supply heaters; door heaters; forced draft fans and blowers; draft inducers; auxiliary steam turbines; elbow, straight line and vane-axial duct fans; ventilating fans for industrial and marine applications; and industrial fog eliminators. The company has the rather unique record of having originated and pioneered everything that it manufactures.

ELMER R. KAISER

joins ASHVE as director of research.

The appointment of Elmer R. Kaiser, Columbus, Ohio, as the new director of research for the American Society of Heating and Ventilating Engineers has been announced.

Mr. Kaiser was appointed to the post by the ASHVE Council and will assume his new duties at the Society Research Laboratory, 7218 Euclid Avenue, Cleveland, Ohio, about September 1st.

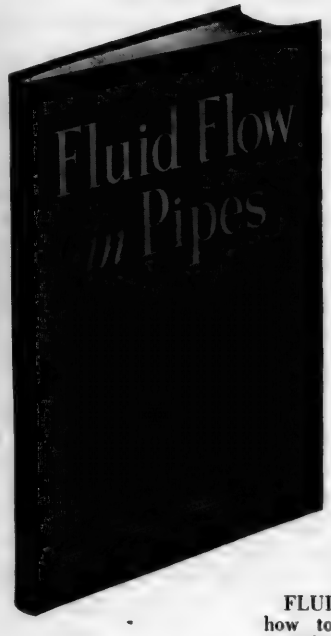
Since his graduation from the University of Wisconsin with a B.S. and M.S. in Mechanical Engineering in 1934, he has been actively engaged in research work particularly in the field of fuels, during the past 20 years he has served on the staff of Battelle Memorial Institute, and with Bituminous Coal Research as assistant to the president, assistant director of research, general manager of B. C. R. Products, Inc., and associate director of research in charge of the B. C. R. Laboratory at Columbus.

E. R. Kaiser

Mr. Kaiser was born in New Holstein, Wis., in 1909 and attended the University of Wisconsin and was a pupil of the late Professor Gustus L. Larson, past president of

(*Continued on page* 140)

Fluid Flow THEORY . . . plus Practical METHODS and FORMULAS Plus Detailed, Worked-Out EXAMPLES



by
Clifford H. McClain
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Clarifies the handling of problems involving the flow of liquids and gases through pipes and ducts. In simple language, it explains the fundamental processes involved, and shows in detail the derivation and use of all formulas.

Since problems involving force require dimensional expression, this book places emphasis on the theory and practice of fluid flow from a dimensional standpoint, and the importance of maintaining consistent expression of dimensional relationships in solving problems.

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The conditions of turbulence and streamline flow as they affect problems in friction and energy balance are discussed fully. Consistency in the evaluation of such factors as the Reynolds number is emphasized. Empirical formulas used in flow calculations are presented with a discussion of the physical basis of such formulas. Throughout the book, applications of the principles to problems in piping are presented with worked-out examples.

128 Pages **9 Tables** **18 Illustrations**

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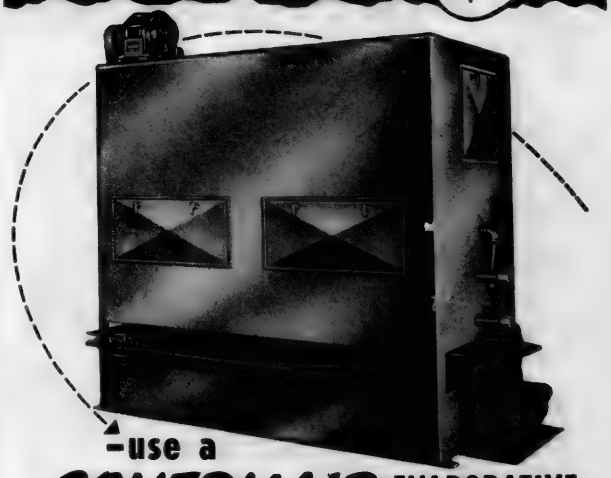
When water is a *Headache*...



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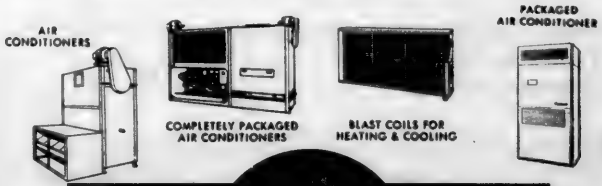

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Chillers

E. R. KAISER

(*Continued from page* 138)

the society. He is a licensed professional engineer in the State of Ohio and the Commonwealth of Pennsylvania and is a member of the honorary fraternities, Tau Beta Pi, Pi Tau Sigma, and Phi Eta Sigma.

In his professional work, Mr. Kaiser has had wide administrative experience, the planning and supervision of important research programs and has written extensively on subjects dealing with combustion, heat generating equipment, air pollution and utilization of coal.

Mr. Kaiser holds membership in A.S.M.E., A.I.M.E. and has served as chairman or member of A.S.M.E. Fuels Division, A.I.M.E. Committee on Research, the A.I.M.E.-A.S.M.E. Joint Fuels Conference, A.S.M.E. Power Test Code Committee 16, A.S.M.E. Columbus Section Executive Committee, Air Pollution Control Association and he is also a trustee of the Central Ohio Technical Foundation.

INSTRUMENTATION

for industrial hygiene is reviewed at symposium and exhibition at Ann Arbor.

The University of Michigan's Symposium on Instrumentation for Industrial Hygiene, held May 24-27 at Ann Arbor, was attended by more than six hundred registrants, including manufacturer's technical representatives and 30 speakers. The event was co-sponsored by the University's Institute of Industrial Health and School of Public Health. Over one-hundred exhibitors included both manufacturers and industrial hygienists displaying their own devices.

• **INSTRUMENTS.**—Typical of the ingenuity shown in modern developments among these instruments was one which permits the reading of dust concentrations of an airstream directly on a calibrated dial. As particle size is important to dust exposure evaluations, the instrument goes even further and can be set to give dust particle counts above selected minimum sizes.

Devised by the industrial hygienists themselves were such devices as an apparatus for collecting and analyzing halogenated hydro-carbon vapor from a dozen different locations. Another instrument provides a means of preparing known concentrations of solvent vapor in air in which weighed ampoules of the solvent inside a glass tube were smashed by a steel ball raised by means of a magnet. Other instruments ranged from automatic air samplers and recorders to an automatic evaporator for solutions of radio-active materials.

• **PURPOSE.**—The Symposium fulfilled a threefold purpose: bringing the registrants up-to-date on instrumentation in this field; informing manufacturers what is needed by users; providing material for an Encyclopedia on Instrumentation for Industrial Hygiene, which is now under preparation and will be available in the near future.

PIPING AND PLUMBING

(*Concluded from page* 98)

of its diameter and depth, every precaution should be taken in design and construction to prevent structural failure. In addition, as mentioned earlier, the dry well should be located above the mean high level of the ground water table. A typical dry well installation is illustrated.

The dry well used as an example in Fig. 2, is of the reinforced pre-cast concrete type. The space around the dry well has been filled with crushed stone for the following reasons.

(1) Crushed stone allows for free and easy drainage.

(2) Soot and other matter that settles on the roof of a building in dry weather is washed into the dry well during a storm where it will in time, form an impervious layer on the surface of the close grained earth in contact with the exterior of the drainage slots, thus greatly reducing the effective rate of drainage. The crushed stone will prevent this action, by allowing the small particles of foreign matter to disperse. Normally years will elapse before a sufficient accumulation of silt could retard the drainage.

These points when considered during the design period, will assure a dry well system of adequate size and complete fulfillment of efficiency in function. The same considerations may also be applied to existing dry wells in order to increase their drainage capacity. When the drainage capacity of a dry well that has been in operation for a number of years becomes troublesome, it is reasonable to assume that the porous quality of the soil immediately surrounding the dry well has become clogged with impervious foreign matter. To correct this condition, it is necessary to dig out this earth and replace it with fresh sand or gravel, and crushed stone in a manner shown in Fig. 2, and the dry well, will again function properly.

EXPERIENCE IS MY CLASSROOM

(*Concluded from page* 126)

sirable automatic devices act on the dip of wave with unclean water and lowered water level due to non-equalization. Obviously, the water should be maintained clean.

Any boiler with a revertible flue may collect cold air during off-boiler periods. This affects the oil burner when it first comes on and since it is more difficult for the chimney draft to pull through such downward flues, the draft may favor the down flue of one boiler over that of the other. Sometimes the check valve on a pump discharge will slowly leak backward while the pump is stopped. Float regulation will then cause frequent starting of the pump, usually a sure indication of such leakage, and, of course, this makes a lowered water level within the boiler. The importance of direct connections may be better appreciated when one reflects that water levels in the several sections of a cast iron boiler are not uniform, even though these sections are connected top and bottom with large nipple ports. Some sections will be more active in circulation and evaporation, most likely those receiving radiant energy from the fire, or the hottest gases. Again it may be where gases are constricted to make most intimate contact with water backed surfaces, or where most of the heating surface lies, as in a rear section.

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EXHAUST

INSTALL BURT F.E.F.
POWER VENTILATORS

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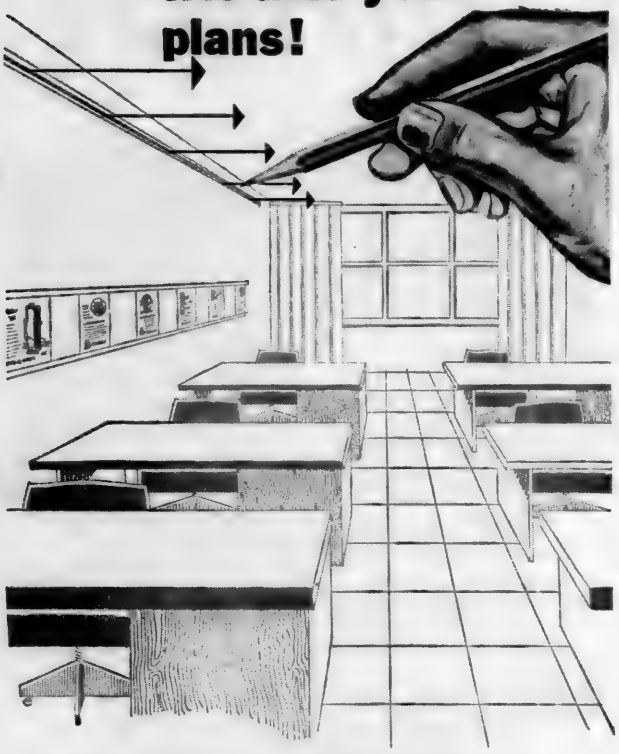

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AIR DIFFUSERS • FILTERS • EXHAUSTERS

ABSTRACTS AND REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

NEW YORK STATE CODE MANUAL

The New York State Building Code Commission has published the second edition of its Code Manual, a 308-page illustrated handbook on construction standards. The manual is designed to assist architects, engineers, builders, and building officials in the application of the performance requirements of the State Building Construction Code relating to one- and two-family dwellings and multiple dwellings.

The manual describes—through text, tables, and illustrations—methods and materials acceptable as meeting the requirements of the state code, without prescribing their use. All techniques, equipment and products meeting the performance requirements of the code are acceptable under the law, whether or not they are described or illustrated in the manual.

The content and scope of the new manual have been enlarged from the first edition published two years ago. It is divided into five parts corresponding to the major divisions of the code. These are general provisions, space standards, structural standards, fire-safety standards, and equipment standards.

Such subjects as the following are dealt with: plumbing, heating, building height and fire areas, yards and courts, soil bearing values, protection against ground water and termites, distance separations, construction limitations, fire separations, electrical wiring and equipment, and fire alarm systems.

Code Manual for the State Building Construction Code. Hard cover with ring binder, 8½ x 11 inches, 308 pages. Published by the State Building Code Commission, 1740 Broadway, New York 19, N. Y. Price, $3.

• • •

DICTIONARY OF BUSINESS AND INDUSTRY

Something new in the family of dictionaries is The Dictionary of Business and Industry, edited by Robert J. Schwartz, which contains definitions of 45,000 business, trade, industrial and legal terms.

In compiling the book, each of the 1100 business associations in the United States was requested to supply the terms used in their fields, and assistance was also obtained from important men in the various professions and in government service. From the large amount of information collected, the terms in general use were eliminated and many definitions repharased. As the result of this extensive task, there is now available a dictionary that lists words used in business and industry that are not found in ordinary dictionaries. It is a book that should prove to be a valuable reference volume to be kept handy for use by men in business and industry.

The Dictionary of Business and Industry, edited by R. J. Schwartz. Cloth bound, 5½ x 8¼ inches, 561 pages. Published by B. C. Forbes & Sons Publishing Company, 80 Fifth Avenue, New York 11, N. Y. Price, $7.95 and with thumb index, $8.95.

RATINGS FOR BASEBOARD AND C. I. BOILERS—The sixth edition of I-B-R Ratings contains all I-B-R ratings in effect on April 1, 1954, for boilers and baseboards of all types currently being produced. This edition lists ratings for boilers made by 25 American and Canadian manufacturers, and ratings for baseboards of all types made by 26 manufacturers. The I-B-R Code specifies the rigid conditions under which tests must be conducted. The Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17, N. Y. Price, 75 cents.

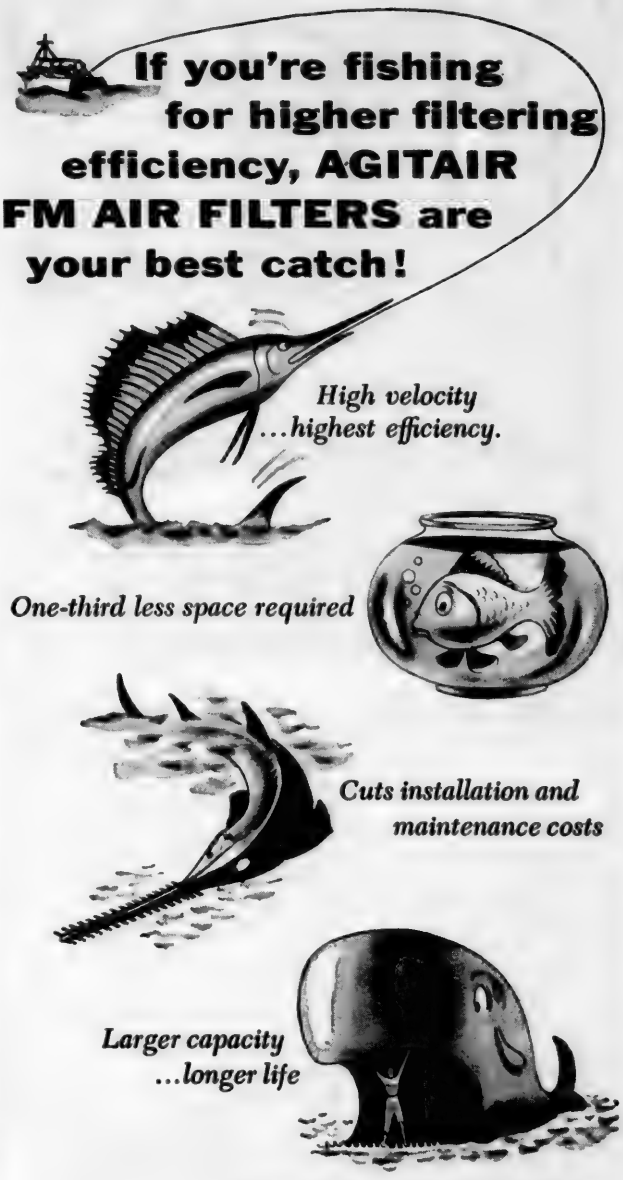
SHEET METAL WEIGHT CALCULATOR—A slide-type calculator for determining the weight of sheet metal has been developed. Weights can be quickly determined for many types of special and commodity steel sheets, including coated and uncoated grades, stainless steel sheets and plates, and the commonly used non-ferrous metals. On the reverse side of this calculator is a gage, weight and thickness table for stainless steel and hot and cold rolled mild steel sheets, strips and plates. Marketing Service Department, Armco Steel Corporation, Middletown, Ohio. Price, 50 cents.

DUST FALL MEASUREMENTS—A paper on Variables in Monthly Dust Fall Measurements by J. D. Sensenbaugh and W. C. L. Hemeon was presented at the annual meeting of the American Society for Testing Materials. This paper discusses monthly dust fall measurements by the open-jar method, location of jar stations and the treatment of data. Free copies are available by writing to: Industrial Hygiene Foundation, Mellon Instiute, 4400 Fifth Avenue, Pittsburgh 13, Pa.

BUILDING CONSTRUCTION AND MAINTENANCE BIBLIOGRAPHY—This bibliography lists title of papers dealing with the practical aspects of building construction and also some papers of a more technical nature. A few ASA and ASTM standards are also listed. This Report 140 on Selected Bibliography on Building Construction and Maintenance lists the government publications that are free and those which are sold by the Government Printing Office, Washington 25, D. C. Price, 30 cents.

SAMPLER FOR HYDROGEN SULFIDE—J. D. Sensenbaugh and W. C. L. Hemeon have prepared a paper on a Low-Cost Sampler for Measurement of Low Concentration of Hydrogen Sulfide. It describes the instrument and discusses its use. For a copy of this, write to: Industrial Hygiene Foundation, Mellon Institute, 4400 Fifth Avenue, Pittsburgh 13, Pa.

GAS UTILIZATION—A spiral-bound 69-page booklet on Data Book on Gas Utilization has been issued by the Pacific Coast Gas Association to be of value to architects, engineers, contractors and builders. Much of the data presented are from the American Gas Association. Covered in this book are design of gas piping, gas vents and vent connectors, domestic water heating, incinerators, gas refrigerators, gas ranges, commercial water heating, warm air house heating, steam and hot water heating systems, and associated subjects. Pacific Coast Gas Association, 2 Pine Street, San Francisco, California. Price, $1.00.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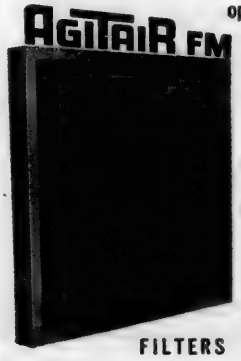

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Gentlemen:
Please rush Bulletin 5/54 on the NEW, EASY-TO-SELL THERMOBLOC Type AF Model 2000. I would like more information on a distributorship. My Company resume is enclosed.

Name.....Title.....
Company.....
Address.....
City.....State.....

DEGREE DAYS FOR JUNE, 1954

(A) Airport readings; (C) city office readings; (O) Readings at a point on outskirts of city.

Totals for the 1953 and 1954 heating seasons will be given on these pages next month.

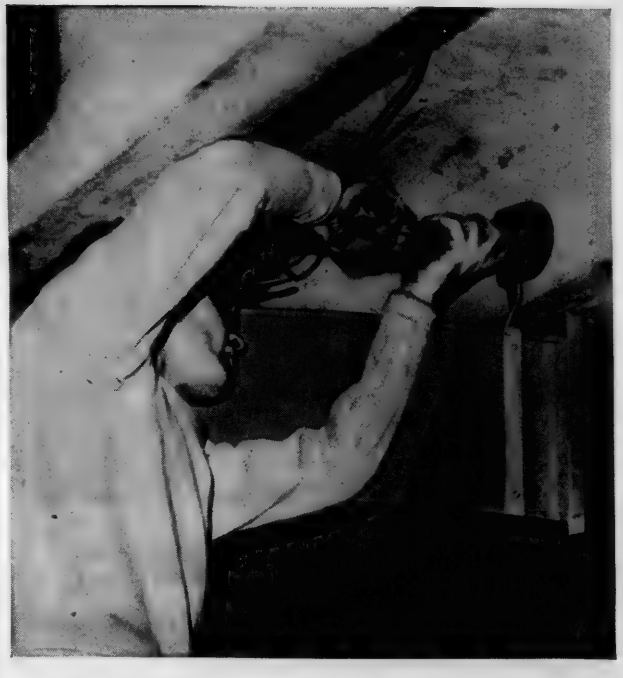
City	June 1954	June 1953	Normal
Abilene, Texas (A)	0	0	0
Albany, New York (A)	35	47	50
Albuquerque, New Mexico (A)	2	0	0
Alpena, Michigan (C)	109	118	135
Anaconda, Montana (C)	377	328	251*
Asheville, North Carolina (C)	19	0	5
Atlanta, Georgia (A)	7	0	0
Atlantic City, New Jersey (C)	12	24	24
Augusta, Georgia (A)	0	0	0
Baltimore, Maryland (C)	0	15	0
Billings, Montana (A)	168	125	119
Binghamton, New York (C)	26	53	48
Birmingham, Alabama (A)	3	0	0
Bismarck, North Dakota (A)	131	104	116
Block Island, Rhode Island (A)	67	72	96
Boise, Idaho (A)	172	170	92
Boston, Massachusetts (A)	61	32	42
Bozeman, Montana (C)	306	230	230*
Buffalo, New York (A)	56	44	72
Burlington, Iowa (A)	35	1	34
Burlington, Vermont (A)	63	64	72
Butte, Montana (C)	343	252	236*
Cairo, Illinois (C)	2	0	0
Charleston, South Carolina (C)	0	0	0
Charlotte, North Carolina (A)	1	0	0
Chattanooga, Tennessee (A)	5	0	0
Cheyenne, Wyoming (A)	143	111	173
Chicago, Illinois (C)	44	29	59
Cincinnati, Ohio (C)	14	0	0
Cleveland, Ohio (A)	36	10	46
Columbia, Missouri (A)	22	0	14
Columbia, South Carolina (C)	0	0	0
Columbus, Ohio (C)	23	4	22
Concord, New Hampshire (A)	85	86	82
Concordia, Kansas (C)	26	6	20
Dallas, Texas (A)	0	0	0
Dayton, Ohio (A)	32	3	39
Deer Lodge, Montana (C)	337	282	235*
Denver, Colorado (A)	42	30	65
Des Moines, Iowa (A)	39	8	45
Detroit, Michigan (A)	46	15	60
Devils Lake, North Dakota (C)	144	133	137
Dodge City, Kansas (A)	16	5	15
Dubuque, Iowa (A)	51	21	76
Duluth, Minnesota (C)	180	214	200
Eastport, Maine (C)	(a)	238	288
Elkins, West Virginia (A)	53	30	53
El Paso, Texas (A)	0	0	0
Ely, Nevada (A)	248	225	200
Erie, Pennsylvania (C)	(a)	32	55
Escanaba, Michigan (C)	123	116	166
Evansville, Indiana (A)	15	0	6
Fargo, North Dakota (A)	75	102	101
Forth Smith, Arkansas (A)	2	0	0
Fort Wayne, Indiana (A)	43	5	53
Fort Worth, Texas (A)	0	0	0
Fresno, California (A)	21	22	0
Galveston, Texas (C)	0	0	0
Grand Junction, Colorado (A)	40	7	23
Grand Rapids, Michigan (A)	62	16	79
Green Bay, Wisconsin (A)	78	50	107
Greensboro, North Carolina (A)	6	1	0
Greenville, South Carolina (A)	1	1	0
Harrisburg, Pennsylvania (A)	10	19	14
Hartford, Connecticut (A)	21	34	31
Hatteras, North Carolina (C)	0	0	0
Havre, Montana (C)	190	147	125
Helena, Montana (A)	287	222	197
Houston, Texas (C)	0	0	0
Huron, South Dakota (A)	58	41	80
Indianapolis, Indiana (A)	24	1	30
Jackson, Mississippi (A)	0	0	0
Kansas City, Missouri (A)	10	0	8
Knoxville, Tennessee (A)	7	0	0
La Crosse, Wisconsin (A)	53	26	74
Lander, Wyoming (A)	166	129	163
Lansing, Michigan (A)	62	19	70
Lewiston, Maine (O)	126	58	45*
Lincoln, Nebraska (C)	26	10	32
Little Rock, Arkansas (A)	0	0	0

City	June		
	1954	1953	Normal
Livingston, Montana (C)	284	259	142*
Los Angeles, California (C)	9	26	19
Louisville, Kentucky (A)	12	0	5
Lynchburg, Virginia (A)	10	3	5
Macon, Georgia (A)	0	0	0
Madison, Wisconsin (C)	55	18	79
Marquette, Michigan (C)	157	149	189
Memphis, Tennessee (A)	0	0	0
Meridian, Mississippi (A)	0	0	0
Milwaukee, Wisconsin (A)	69	57	109
Minneapolis, Minnesota (A)	39	37	80
Moline, Illinois (A)	39	2	45
Montgomery, Alabama (A)	0	0	0
Nantucket, Massachusetts (A)	129	93	139
Nashville, Tennessee (A)	10	0	0
New Haven, Connecticut (A)	31	49	52
New Orleans, Louisiana (C)	0	0	0
New York, New York (C)	9	17	18
Newark, New Jersey (A)	7	15	11
Norfolk, Virginia (A)	0	1	0
North Head, Washington (C)	(a)	(a)	285
North Platte, Nebraska (A)	45	25	59
Oak Ridge, Tennessee (C)	11	0	(a)
Oakland, California (A)	124	130	119
Oklahoma City, Oklahoma (C)	4	0	0
Omaha, Nebraska (A)	24	10	32
Parkersburg, West Virginia (C)	14	3	13
Peoria, Illinois (A)	31	0	41
Philadelphia, Pennsylvania (C)	4	16	0
Phoenix, Arizona (A)	0	0	0
Pittsburgh, Pennsylvania (C)	16	2	13
Pittsfield, Massachusetts (A)	97	116	105
Pocatello, Idaho (A)	205	168	136
Portland, Maine (A)	146	129	117
Portland, Oregon (C)	176	166	70
Providence, Rhode Island (A)	50	36	58
Pueblo, Colorado (A)	9	5	27
Raleigh, North Carolina (A)	2	0	0
Rapid City, South Dakota (A)	108	68	148
Reading, Pennsylvania (C)	6	21	11
Red Bluff, California (A)	21	22	0
Reno, Nevada (A)	193	235	165
Richmond, Virginia (A)	1	4	0
Rochester, New York (A)	48	51	54
Roswell, New Mexico (A)	0	0	0
Sacramento, California (C)	22	33	5
St. Joseph, Missouri (A)	12	1	11
St. Louis, Missouri (C)	9	0	7
Salt Lake City, Utah (A)	100	64	81
San Antonio, Texas (A)	0	0	0
San Diego, California (A)	20	27	43
Sandusky, Ohio (C)	28	6	41
San Francisco, California (C)	200	212	180
Sault Ste. Marie, Michigan (A)	169	218	224
Savannah, Georgia (A)	0	0	0
Scranton, Pennsylvania (C)	(a)	41	35
Seattle, Washington (C)	200	187	107
Sheridan, Wyoming (A)	190	127	161
Shreveport, Louisiana (A)	0	0	0
Sioux City, Iowa (A)	39	14	54
Spokane, Washington (A)	237	231	146
Springfield, Illinois (A)	26	0	14
Springfield, Missouri (A)	14	0	16
Syracuse, New York (A)	33	55	37
Tacoma, Washington (C)	(a)	(a)	143
Terre Haute, Indiana (A)	21	2	24
Toledo, Ohio (A)	39	13	60
Topeka, Kansas (C)	11	0	13
Trenton, New Jersey (C)	14	25	11
Tulsa, Oklahoma (A)	4	0	0*
Utica, New York (O)	57	74	0
Valentine, Nebraska (C)	67	41	83
Walla Walla, Washington (C)	114	85	38
Washington, D. C. (C)	1	13	0
Wichita, Kansas (A)	13	0	7
Williston, North Dakota (C)	173	134	138
Winnemucca, Nevada (A)	207	216	111
Yakima, Washington (A)	171	186	53

(a) Data not available.

*Same normal figures as previously listed by HEATING AND VENTILATING since new figures are not available. All other normal figures in this table are based on a 30-year period covering 1921 to 1950, inclusive, recently compiled and published by the U. S. Weather Bureau.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.



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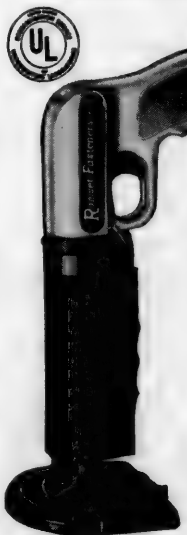

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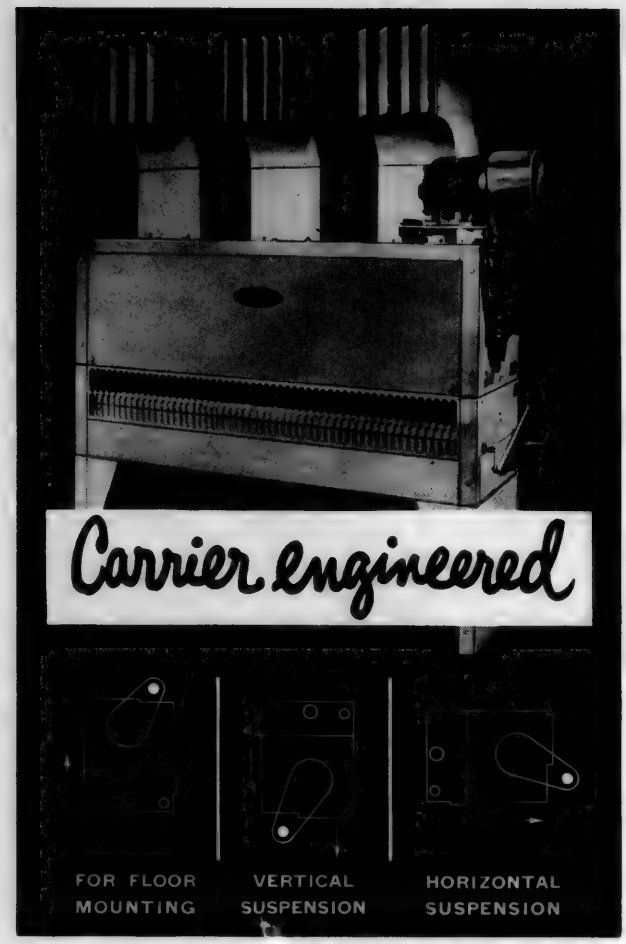

CARRIER Heating and Ventilating Units offer the most economical method of heating and ventilating large areas in factories, warehouses, garages, hangars, commercial and industrial buildings. In three sectional types—six basic sizes each, with either right or left hand coil connections—they afford a flexibility for meeting any steam or hot water installation and capacity requirement (115,000 to 2,390,000 Btu per hour). Accessories include complete line of filter boxes, intakes, diffusers and controls.

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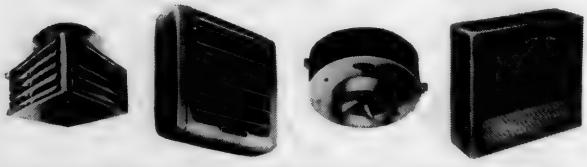
For complete list of features and selection data, WRITE to Carrier Corporation, Syracuse, New York.



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AIR CONDITIONING
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COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

METEOROLOGICAL SOCIETY MEETING—130th meeting of the American Meteorological Society, at the Rochester Chamber of Commerce, Rochester, N. Y. Secretary of the Society, 5 Joy St., Boston 8, Mass. . . . . **AUGUST 24-25, 1954.**

ASME MEETING—Fall meeting of the American Society of Mechanical Engineers, at the Schroeder Hotel, Milwaukee, Wis. Secretary of the Society, 29 West 39th St., New York, N. Y. . . . . **SEPTEMBER 8-10, 1954.**

CHEMICAL SOCIETY MEETING—126th national fall meeting of the American Chemical Society, in New York City. R. M. Warren, secretary of the Society, 1155 Sixteenth St. N.W., Wash. 6, D. C. . . . . **SEPTEMBER 12-17, 1954.**

INTERNATIONAL INSTRUMENT CONGRESS—First International Instrument Congress and Exposition, sponsored by The Instrument Society of America, to be held in the Commercial Museum and Convention Hall, Philadelphia, Pa. Richard Rimbach, managing director of the Exposition, 845 Ridge Ave., Pittsburgh 12, Pa. . . . . **SEPTEMBER 13-25, 1954.**

PLUMBING AND HEATING CONVENTION—Third annual convention of the American Institute of Wholesale Plumbing & Heating Supply Associations, at New Orleans, La. George T. Underwood, executive secretary, 402 Albee Bldg., Washington, D. C. . . . . **SEPTEMBER 19-22, 1954.**

AGA CONVENTION—Annual convention of the American Gas Association, at Convention Hall, Atlantic City, N. J. Secretary of the Association, 420 Lexington Ave., New York, N. Y. . . . . **OCTOBER 11-13, 1954.**

ELECTRICAL ENGINEERS MEETING—Fall general meeting of the American Institute of Electrical Engineers, at the Hotel Morrison, Chicago, Ill. Secretary of the Institute, 33 West 39th St., New York 18, N. Y. . . . . **OCTOBER 11-15, 1954.**

SAFETY CONGRESS AND EXPOSITION—42nd National Safety Congress and exposition, of the National Safety Council, at Chicago, Ill. R. L. Forney general secretary of the Council, 425 No. Michigan Ave., Chicago 11, Ill. . . . **OCTOBER 18-22, 1954.**

ASA CONFERENCE—Fifth national conference on Standards and 36th annual meeting of the American Standards Association, at the Roosevelt Hotel, New York, N. Y. Secretary of the Association, 70 East 45th St., New York 17, N. Y. . . . . **NOVEMBER 15-17, 1954.**

REFRIGERATION ENGINEERS CONVENTION—17th Annual convention of the Refrigeration Service Engineers Society, at the Raddison Hotel, Minneapolis, Minn. Secretary of the Society, 2577 No. Teutonia Ave., Milwaukee 6, Wis. . . . . **NOVEMBER 18-21, 1954.**

ASME MEETING—Annual meeting of the American Society of Mechanical Engineers, at the Statler Hotel, New York City. Secretary of the Society, 29 W. 39th St., New York City. . . . . **NOVEMBER 28-DECEMBER 3, 1954.**

POWER SHOW—21st National Exposition of Power and Mechanical Engineering, at the Comercial Museum, Philadelphia, Pa., to be held under the auspices of The American Society of Mechanical Engineers. Charles F. Roth, manager of the Exposition, 480 Lexington Ave., New York 17, N. Y. . . . . **DECEMBER 2-7, 1954.**

NATIONAL RETAIL INDUSTRY SHOW—First National Retail Industry Show of the Store Modernization Institute, combined with the 5th Store Modernization Show at Madison Square Garden, New York, N. Y. John W. H. Evans, secretary of the Institute and managing director of the Show, 20 E. 55th St., New York, N. Y. . . . . **JANUARY 7-11, 1955.**

SOLAR ENERGY SYMPOSIUM—A world symposium on applied solar energy, sponsored by Stanford Research Institute, Stanford, Calif. at the Westward Ho Hotel, Phoenix, Ariz. Chairman of the Institute, 612 S. Flower St., Room 332, Los Angeles 14, Calif. . . . . **JANUARY 12-15, 1955.**

HEATING & VENTILATING EXPOSITION—12th International Heating & Ventilating Exposition, at the Commercial Museum and Convention Hall, Philadelphia, Pa., held under the auspices of the American Society of Heating and Ventilating Engineers. Charles F. Roth, manager of the Exposition, 480 Lexington Ave., New York 17, N. Y. . . . . **JANUARY 24-28, 1955.**

LUBRICATION ENGINEERS MEETING—Annual meeting and exhibit of the American Society of Lubrication Engineers, at the Hotel Sherman, Chicago, Ill. Wm. P. Youngclaus, Jr., secretary of the Society, 84 E. Randolph St., Chicago 1, Ill. . . . . **APRIL 13-15, 1955.**

INTERNATIONAL CONGRESS OF REFRIGERATION—Ninth International Congress of Refrigeration, sponsored by the International Institute of Refrigeration, to be held in the conference rooms of the Sorbonne in Paris, France. General Secretariat of the Congress, International Institute of Refrigeration, 177, Boulevard Malesherbes, Paris, France . . . . . **AUGUST 31-SEPTEMBER 15, 1955.**

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To sell Plumbing and Heating Specialties and Supplies for established New York firm exclusive territory. Commission. Replies confidential. AKRON SUPPLY CO., INC., 216 Grand Street, Brooklyn, N. Y.

MANUFACTURERS AGENTS wanted—exclusive territory will be granted to qualified persons—for automatic electric damper control for coal, gas or oil fired boilers. Box No. 830, HEATING AND VENTILATING, 148 Lafayette St., New York 13, N. Y.

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For expanding well known company manufacturing plumbing drainage products. We are looking for a man who knows all elements of the plumbing industry, including engineers, plumbers and jobbers. We prefer a man with management background, such as manager of large jobbing branch, or sales manager or executive of large plumbing firms now in the field. Salary is adaptable to man. All details will be held in strictest confidence. Write Box No. 831, HEATING AND VENTILATING, 148 Lafayette St., New York 13, N. Y.

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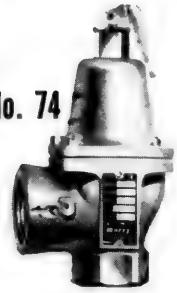
. . . for Boiler Heating Systems

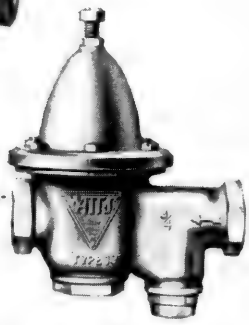
For heating systems whether by hot water or steam, Watts pioneering research and engineering skill have produced protective and controlling devices that make water heating systems safe, efficient, automatic . . . Watts manufacturing efficiency and excellent workmanship provide you with quality controls, which enable you to render real service to your customers. Protect systems by installing the most advanced controls and safety devices.

SEND FOR COMPLETE CATALOGUE

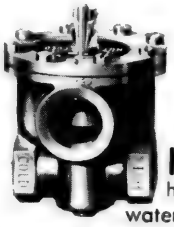
No. 74



Nos. 74 and 174 series ASME boiler safety relief valves sizes ¾" thru 2"



No. 135HW
feed water pressure regulator



No. 71
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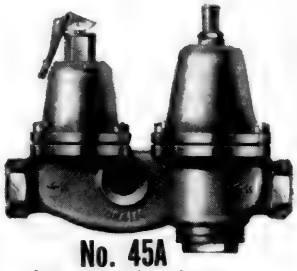

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hot water heating dual control de luxe all bronze construction

No. 89A
low pressure, low water cut-off for gauge glass installations

No. 60LWD
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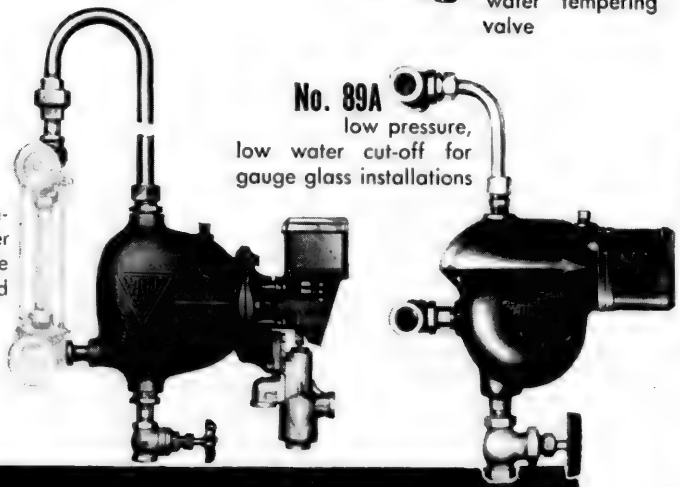


WATTS REGULATOR COMPANY

Plumbing and Heating Safety Valves and Controls

Since 1875

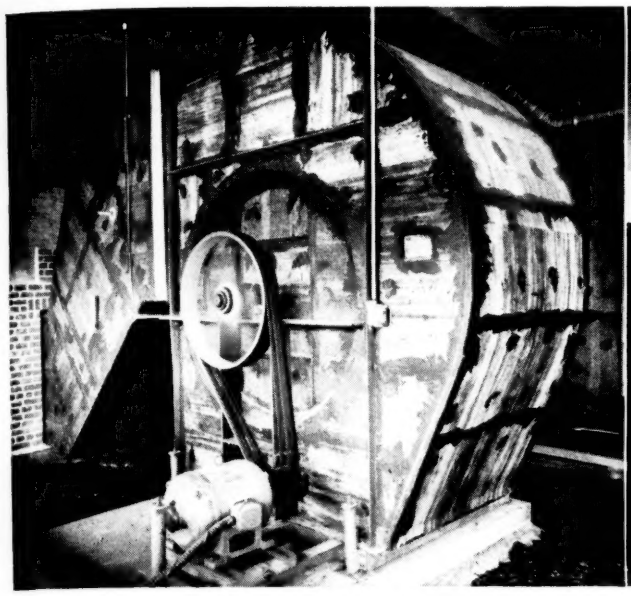
LAWRENCE, MASSACHUSETTS

WEIGHTS OF GALVANIZED STEEL DUCTS—31 × 31 TO 45 × 45 IN.

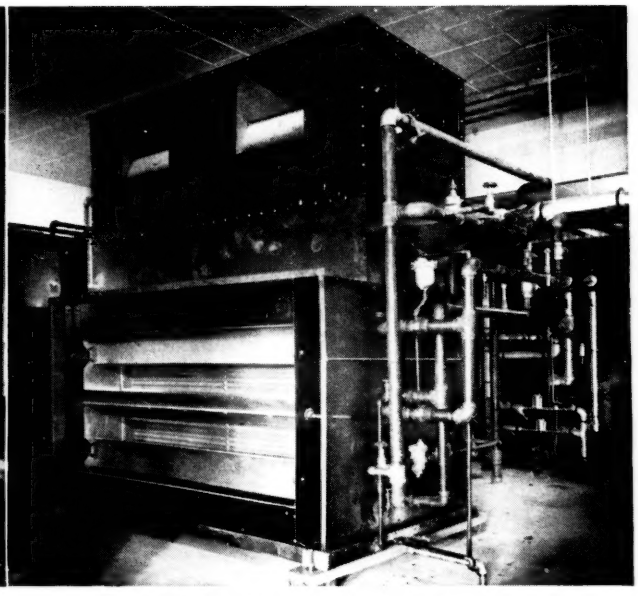
Gage	Weight of Galvanized Steel Duct per Lineal Foot																Gage
16		29.03	29.48	29.93	30.38	30.83	31.28	31.73	32.18	32.63	33.08	33.53	33.98	34.43	35.10	35.55	16
18		23.65	24.02	24.38	24.75	25.12	25.48	25.85	26.22	26.58	26.95	27.32	27.68	28.05	28.60	28.97	18
20		18.28	18.56	18.84	19.13	19.41	19.69	19.98	20.26	20.54	20.83	21.11	21.39	21.68	22.10	22.38	20
22		15.05	15.28	15.52	15.75	15.99	16.21	16.45	16.68	16.92	17.15	17.39	17.60	17.85	18.20	18.42	22
24		12.90	13.10	13.30	13.50	13.70	13.90	14.10	14.30	14.50	14.70	14.90	15.10	15.30	15.60	15.80	24
26		9.68	9.84	9.98	10.11	10.29	10.41	10.58	10.72	10.88	11.02	11.18	11.31	11.48	11.70	11.85	26
Width of Duct, Inches	Square Feet of Duct Surface per Lineal Foot of Duct																Width of Duct, Inches
		10.33	10.50	10.67	10.83	11.00	11.17	11.33	11.50	11.67	11.83	12.00	12.17	12.33	12.50	12.67	
	Height of Duct, Inches																
31		31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	31
32	45		31	32	33	34	35	36	37	38	39	40	41	42	43	44	32
33	44	45		31	32	33	34	35	36	37	38	39	40	41	42	43	33
34	43	44	45		31	32	33	34	35	36	37	38	39	40	41	42	34
35	42	43	44	45		31	32	33	34	35	36	37	38	39	40	41	35
36	41	42	43	44	45		31	32	33	34	35	36	37	38	39	40	36
37	40	41	42	43	44	45		31	32	33	34	35	36	37	38	39	37
38	39	40	41	42	43	44	45		31	32	33	34	35	36	37	38	38
39	38	39	40	41	42	43	44	45		31	32	33	34	35	36	37	39
40	37	38	39	40	41	42	43	44	45		31	32	33	34	35	36	40
41	36	37	38	39	40	41	42	43	44	45		31	32	33	34	35	41
42	35	36	37	38	39	40	41	42	43	44	45		31	32	33	34	42
43	34	35	36	37	38	39	40	41	42	43	44	45		31	32	33	43
44	33	34	35	36	37	38	39	40	41	42	43	44	45		31	32	44
45	32	33	34	35	36	37	38	39	40	41	42	43	44	45		31	45
Gage	Square Feet of Duct Surface per Lineal Foot of Duct																Gage
	12.83	13.00	13.17	13.33	13.50	13.67	13.83	14.00	14.17	14.33	14.50	14.67	14.83	15.00			
	Weight of Galvanized Steel Duct per Lineal Foot																
26	12.00	12.15	12.30	12.45	12.60	12.75	12.90	13.05	13.20	13.35	13.50	13.65	13.78	13.97			26
24	16.00	16.20	16.40	16.60	16.80	17.00	17.22	17.40	17.60	17.80	18.00	18.20	18.40	18.70			24
22	18.66	18.90	19.12	19.35	19.60	19.85	20.05	20.28	20.53	20.76	21.00	21.24	21.46	21.80			22
20	22.67	22.95	23.23	23.52	23.80	24.08	24.37	24.65	24.93	25.22	25.50	25.78	26.07	26.49			20
18	29.33	29.70	30.07	30.43	30.80	31.17	31.53	31.90	32.27	32.63	33.00	33.37	33.73	34.28			18
16	36.00	36.45	36.90	37.35	37.80	38.25	28.70	39.15	39.60	40.05	40.50	40.95	41.40	42.08			16

WEIGHTS OF GALVANIZED STEEL DUCTS—31 × 46 TO 45 × 60 IN.

Gage	Weight of Galvanized Steel Duct per Lineal Foot															Gage
16		36.00	36.45	36.90	37.35	37.80	38.25	38.70	39.15	39.60	40.05	40.50	40.95	41.40	42.08	42.53	16
18		29.33	29.70	30.07	30.43	30.80	31.17	31.53	31.90	32.27	32.63	33.00	33.37	33.73	34.28	34.65	18
20		22.67	22.95	23.23	23.52	23.80	24.08	24.37	24.65	24.93	25.22	25.50	25.78	26.07	26.49	26.78	20
22		18.66	18.90	19.12	19.35	19.60	19.85	20.08	20.28	20.53	20.76	21.00	21.24	21.46	21.80	22.05	22
24		16.00	16.20	16.40	16.60	16.80	17.00	17.20	17.40	17.60	17.80	18.00	18.20	18.40	18.70	18.90	24
26		12.00	12.15	12.30	12.45	12.60	12.75	12.90	13.05	13.20	13.35	13.50	13.65	13.78	13.97	14.18	26
Width of Duct, Inches	Square Feet of Duct Surface per Lineal Foot of Duct															Width of Duct, Inches
		12.83	13.00	13.17	13.33	13.50	13.67	13.83	14.00	14.17	14.33	14.50	14.67	14.83	15.00	15.17	
	Height of Duct, Inches															
31		46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	31
32	60		46	47	48	49	50	51	52	53	54	55	56	57	58	59	32
33	59	60		46	47	48	49	50	51	52	53	54	55	56	57	58	33
34	58	59	60		46	47	48	49	50	51	52	53	54	55	56	57	34
35	57	58	59	60		46	47	48	49	50	51	52	53	54	55	46	35
36	56	57	58	59	60		46	47	48	49	50	51	52	53	54	55	36
37	55	56	57	58	59	60		46	47	48	49	50	51	52	53	54	37
38	54	55	56	57	58	59	60		46	47	48	49	50	51	52	53	38
39	53	54	55	56	57	58	59	60		46	47	48	49	50	51	52	39
40	52	53	54	55	56	57	58	59	60		46	47	48	49	50	51	40
41	51	52	53	54	55	56	57	58	59	60		46	47	48	49	50	41
42	50	51	52	53	54	55	56	57	58	59	60		46	47	48	49	42
43	49	50	51	52	53	54	55	56	57	58	59	60		46	47	48	43
44	48	49	50	51	52	53	54	55	56	57	58	59	60		46	47	44
45	47	48	49	50	51	52	53	54	55	56	57	58	59	60		46	45
Gage	Square Feet of Duct Surface per Lineal Foot of Duct															Gage
	15.33	15.50	15.67	15.83	16.00	16.17	16.33	16.50	16.67	16.83	17.00	17.17	17.33	17.50		
	Weight of Galvanized Steel Duct per Lineal Foot															
26	14.33	14.47	14.63	14.78	14.92	15.08	15.24	15.37	15.53	15.68	15.82	15.98	16.13	16.35		26
24	19.10	19.30	19.50	19.70	19.90	20.10	20.30	20.50	20.70	20.90	21.10	21.30	21.50	21.80		24
22	22.30	22.51	22.75	23.00	23.22	23.45	23.70	23.92	24.15	24.38	24.60	24.85	25.10	25.44		22
20	27.06	27.34	27.63	27.91	28.19	28.48	28.76	29.04	29.33	29.61	29.89	30.18	30.46	30.88		20
18	35.02	35.38	35.75	36.12	36.48	36.85	37.22	37.58	37.95	38.32	38.68	39.05	39.42	39.97		18
16	42.98	43.43	43.88	44.33	44.78	45.23	45.68	46.13	46.58	47.03	47.48	47.93	48.38	49.05		16



In its "work clothes" — completely insulated — one of the Clarage Type NH ventilating fans.



One of the Clarage Multitherm air conditioning units on the job — vertical type shown.

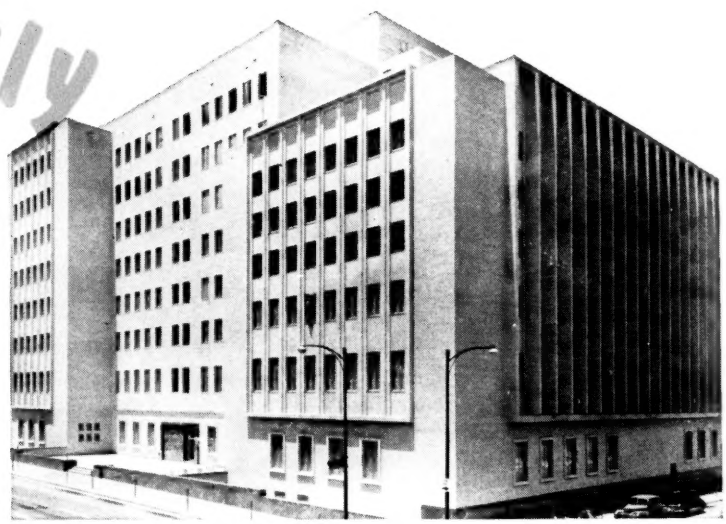
Typically Texas

Harris County boasts 2 new Court Houses at Houston. Clarage equipment installed in both!

Not one, but TWO . . . that's the number of Court Houses serving booming Harris County.

Likewise impressive is the amount of Clarage equipment selected for these two installations. In the **new** Harris County Court House: 49 Multitherm Units, 2 Unicoil Units, 22 fans. In the **remodeled** Harris County Court House: 37 Multitherm Units, 20 fans.

You, too, will find it makes sense to choose dependable Clarage equipment. Your inquiry is invited. **CLARAGE FAN COMPANY, Kalamazoo, Michigan.**



The new Harris County Court House at Houston, Texas. ARCHITECT: Finger and Rustay. ENGINEER: I. A. Naman. CONTRACTOR: Charles G. Heyne & Company.

YOURS FOR THE ASKING

This 68-page illustrated Service Manual provides valuable information adaptable to virtually any air handling job. Send for your free copy today.

You can Rely on...

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Headquarters for Air Handling and Conditioning Equipment

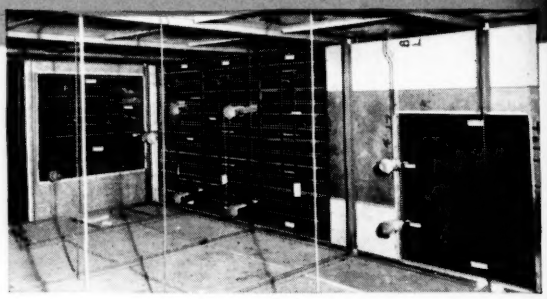
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA Canada Fans, Ltd., 4285 Richelieu St., Montreal

perfect working weather *all year 'round* with

JOHNSON AUTOMATIC TEMPERATURE CONTROL

Addition to The Cincinnati Gas & Electric Company, Cincinnati, Ohio. The Union Central Life Insurance Company, owner. The Cincinnati Gas & Electric Company, lessee. Harry Hake & Harry Hake, Jr., architects; James E. Allan, mechanical engineer; Frank Messer & Sons, Inc., general contractor; Peck-Hannaford & Briggs, heating, ventilating and air conditioning contractors, all of Cincinnati.

Conditioned air for the perimeter of the building is supplied by Carrier Weathermaster units controlled by Johnson Heating-Cooling Thermostats and Water Valves. Other thermostats control a ceiling system supplying conditioned air to the interior areas.

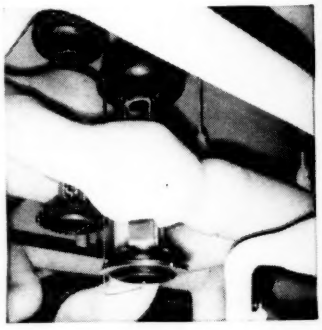


Inside this duct Johnson Damper Operators and Dampers insure precision control of the minimum and maximum outdoor air supply for Weathermaster units throughout the building.

Perfect indoor climate gives workers a big lift in the new Cincinnati Gas & Electric Company addition. Regardless of the outdoor temperatures, employees here enjoy healthful, refreshing climate-controlled weather that keeps worker efficiency and morale at peak levels.

Like the older adjoining building, this new air conditioned addition is equipped with a modern "Planned-for-the-Purpose" Johnson System of Automatic Temperature Control. On this, and *every other installation*, Johnson Control is tailored to the exact needs of the building and its occupants. Each Johnson System is planned, made and installed by Johnson to insure the desired results at the lowest possible operating cost.

Johnson engineers, working with heating and ventilating engineers, architects, owners and builders, have helped to plan control systems for the nation's outstanding office buildings, schools, hospitals, industrial plants, department stores and public buildings from coast to coast. Let a Johnson engineer from a nearby branch office solve your next temperature control problem. A talk involves no obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.



Thermostatically operated Johnson Double Diaphragm Valves are installed on chilled water and condensate lines for summer-winter changeover of the central air conditioning system.

JOHNSON CONTROL

TEMPERATURE AIR CONDITIONING

MANUFACTURING • PLANNING • INSTALLING • SINCE 1885